Boston-Logan International Airport

2011 ESPR

ENVIRONMENTAL STATUS AND PLANNING REPORT

credit: Massport\Rudy Chiarello

April 2013
EOEA #3247

SUBMITTED TO
Executive Office of Energy and Environmental Affairs, MEPA Office

SUBMITTED BY
Massachusetts Port Authority
Economic Planning & Development

PREPARED BY
VHB

IN ASSOCIATION WITH
Harris Miller Miller & Hanson, Inc.
KB Environmental Sciences, Inc.
SH&E, an ICF Company

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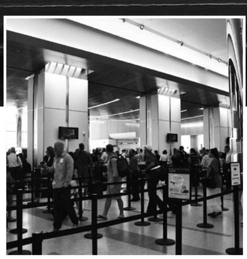

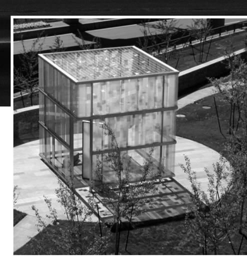

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April 12, 2013

The Honorable Richard K. Sullivan, Jr., Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, Massachusetts 02114

Re: *Logan Airport 2011 Environmental Planning and Status Report* (*2011 ESPR*) - EOEA #3247

Dear Secretary Sullivan:

On behalf of the Massachusetts Port Authority (Massport), I am pleased to submit for your review, the *Boston-Logan International Airport 2011 Environmental Status and Planning Report* (*2011 ESPR*). Logan Airport continued to show improvements in a number of environmental categories in calendar year 2011 through more efficient operations in cleaner and quieter aircraft and a range of Massport and tenant programs aimed at increasing operating efficiencies and reducing impacts. In addition to presenting the environmental analyses of 2011 Logan Airport activities, this ESPR also provides a long-range analysis of cumulative environmental effects in the future based on projected operations and passengers at the Airport in 2030. This represents Massport's best prediction of future impacts based on the most current data available as well as foreseeable trends in the aviation industry. To provide further context, this ESPR places the analyses of the current (2011) and future (2030) conditions at Logan Airport within the context of historical data from 2004 and earlier when there were more operations and largely greater environmental impacts at Logan Airport. *Chapter 1, Introduction/Executive Summary* also provides an expanded discussion of ongoing airport sustainability initiatives.

Logan Airport saw an overall increase in passengers and aircraft operations in 2011. The trend of increasing activity levels at the Airport marked a continued recovery from high fuel prices and the 2008/2009 economic recession that depressed traffic levels across the U.S. Air traffic increases at Logan Airport have been driven primarily by the growth of low-cost carriers (LCCs), including jetBlue Airways and Southwest Airlines, over the past decade. In 2011, passenger levels at Logan Airport reached a new peak, exceeding the previous 2007 historic peak but with fewer aircraft operations. This *2011 ESPR* considers the continuing effects of airlines operating much more efficiently with cleaner and quieter fleets and flying more passengers per aircraft operation for the future 2030 year analysis. While these changes continue to yield environmental benefits, as the economy and aviation industry recover, Massport anticipates increases in activity levels and passenger growth. The analysis for this projected growth is included in the 2030 forecast sections. As described throughout the *2011 ESPR*, Massport remains fully committed to minimizing those effects. The *2011 ESPR* is outlined below.

Content and Structure

The *2011 ESPR* responds fully to the Secretary's Certificate on the *Boston-Logan International Airport 2010 Environmental Data Report* (*EDR)* and reports on the status of airport operations, environmental conditions, and Massport milestones achieved in 2011. The document also provides updates on more recent significant Logan activities. The document incorporates comments made on the *2010 EDR* and consists of a single volume reporting on 2011 conditions and projections for 2030 for the following categories:

- Highlights for 2011 and 2030, including Logan Airport sustainability initiatives;
- Passenger levels, aircraft operations, aircraft fleets and cargo volumes;
- Planning, design and construction activities at Logan Airport;
- Regional transportation statistics and initiatives;
- Key environmental indicators (Ground Access, Noise Abatement, Air Quality/Emissions Reduction, and Water Quality/Environmental Compliance and Management);
- Mitigation status of Logan Airport projects;
- Secretary's Certificate on the *Boston-Logan International Airport 2010 EDR* and other comment letters received on the *2010 EDR*;
- Individual responses to comments received on the *2010 EDR;*
- Proposed scope for a combined *2012/2013 EDR;*
- Distribution list; and
- Supporting technical appendices.

Review Period, Distribution, and Consultation

To facilitate community and agency review of the expanded *2011 ESPR*, Massport requests an extended 45-day public comment period to begin on **April 24, 2013**, the publication date of the next Environmental Monitor, and to end on **June 7, 2013**. The distribution list included as Appendix D indicates that all parties on the distribution list will be sent an electronic copy of the *2011 ESPR* on CD. A smaller number of reviewers will be sent hard copies of the *2011 ESPR*. The full *2011 ESPR* will also be available on Massport's website (www.massport.com).

A public meeting on the *2011 ESPR* is scheduled for **May 22, 2013** at 6:00 PM at the Logan Office Center, One Harborside Drive, East Boston (Logan Airport). We appreciate the MEPA Office's continued participation in these meetings. Additional copies of the *2011 ESPR* may be obtained by contacting Lisa Carisella at (617) 568-3507 during the 45-day public comment period.

Future Filings and Timing

Starting in 1997, Massport has followed a five-year filing cycle for the *EDRs* and *ESPRs*, with EDRs being filed for each year between the ESPRs. While the last Logan ESPR was filed for calendar year 2004, with prior approval from the Secretary, this next ESPR has been deferred to report on 2011 conditions. As with previous ESPRs, the level of effort involved in preparing the broader *2011 ESPR* analyses and new forecast and planning studies that form the foundation of our long-range environmental analysis is considerably greater than that of an annual EDR. Rather than providing the next EDR update for calendar year 2012 in the fall of 2013, as was done for the 1994 and 1995 annual updates, Massport proposes to report on 2012 and 2013 conditions in a combined EDR to be filed in Fall 2014.

Combining the 2012 and 2013 reports will allow Massport to analyze trends as the economy continues to rebound from the 2008/2009 economic recession. Accordingly, Massport requests an extended schedule for filing the *2012/2013*; specifically, Massport requests the Secretary's approval to file a combined 2012 and 2013 *Logan EDR* in fall 2014**.** Like we have done with the current *ESPR*, we will continue to provide interim updates on key environmental topics on the Massport website (http://www.massport.com/environment/Pages/Default.aspx).

Massport hopes that you and other reviewers of the *2011 ESPR* find it informative and complete. We look forward to your review of this document and to close consultation with you and other reviewers in the coming weeks. Please feel free to contact me at (617) 568-3524 or Tom Ennis at (617) 568-3546, if you have any questions.

Very truly yours,

MASSACHUSETTS PORT AUTHORITY

Stewart Dalzell
Deputy Director, Environmental Planning and Permitting

cc: *2011 ESPR* Distribution List (Appendix D in the *2011 ESPR*)

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Introduction/ Executive Summary

Introduction

Boston-Logan International Airport (Logan Airport or Airport), owned and operated by the Massachusetts Port Authority (Massport), is New England's primary international and domestic airport. This *2011 Environmental Status and Planning Report (2011 ESPR)* is one in a series of annual environmental review documents submitted to the Massachusetts Environmental Policy Act (MEPA)[1] Office since 1989 to report on the cumulative environmental effects of Logan Airport's operations and activities. Approximately every five years, Massport prepares ESPRs, which provide an historical and prospective view of Logan Airport. Environmental Data Reports (EDRs), prepared annually in the intervals between ESPRs, provide a review of environmental conditions for the reporting year compared to the previous year.

The scope for this *2011 ESPR* was established by the Secretary of the Executive Office of Energy and Environmental Affairs' (EOEEA) Certificate dated December 16, 2011, which is included in *Appendix A, MEPA Certificates and Responses to Comments*. This *2011 ESPR* updates and compares the data presented in the *2010 EDR*, and presents activity levels (including aircraft operations and passenger activity) and environmental conditions at Logan Airport for calendar year 2011. In addition to the annual report on 2011 conditions, two other primary functions of this *2011 ESPR* are to provide a discussion of future activity levels at Logan Airport through the year 2030 based on an updated forecast, and to predict the associated potential environmental conditions at the Airport in 2030. To enhance the usefulness of the *2011 ESPR* as a reference document for reviewers, this report also presents historical data on the environmental conditions at Logan Airport dating back to 1990 in instances where historical information is available. Historical data are included in the technical appendices.

1 Massachusetts General Laws Chapter 30, Sections 61-62H. MEPA is implemented by regulations published at 301 Code of Massachusetts Regulations (CMR) 11.00 (the "MEPA Regulations").

EOEA # 3247

Submitted By

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Logan Airport Environmental Review Process

This *2011 ESPR* is part of a two-decade-long, progressive state-level environmental review process that assesses Logan Airport's cumulative environmental impacts. The process provides a context against which individual Airport projects meeting state and federal environmental review thresholds are evaluated on a project-specific basis. The Airport-wide and project-specific environmental review processes are described below.

Historical Context for the Logan Airport EDR/ESPR

In 1979, the Secretary of the Executive Office of Environmental Affairs (EOEA) (now EOEEA) issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the Airport through a Generic Environmental Impact Report (GEIR). The Certificate also required interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR evolved into an effective planning tool for Massport and provided projections of environmental conditions so that the cumulative effects of individual projects could be evaluated within a broader context.

EOEEA eliminated GEIRs following the 1998 revisions to its MEPA Regulations. However, the Secretary's Certificate on the *1997 Annual Update*[2] proposed a revised environmental review process for Logan Airport resulting in Massport's preparation of EDRs/ESPRs. In the last several years, aircraft operations and passenger activity levels and associated environmental effects have remained well below levels previously analyzed for Logan Airport. Thus, the forecasted aviation growth presented in the *2004 ESPR*, the predicate upon which the ESPR schedule was initially established, has not occurred. Accordingly, with the approval of the Secretary, Massport prepared *2009* and *2010 EDRs* in lieu of the scheduled ESPR, now presented.

The *2011 ESPR* provides a comprehensive, cumulative analysis of the effects of all Logan Airport activities based on actual and predicted passenger activity and aircraft operation levels in 2011 and 2030 and presents environmental management plans for addressing areas of environmental concern.

2 Certificate of the Secretary of the Executive Office of Environmental Affairs on the *Logan Airport 1997 Annual Update*, issued on October 16, 1998.

Project-Specific Review

While this Airport-wide review provides the broad planning context for proposed projects and future planning concepts, Airport projects are also subject to a project-specific, public environmental review process when state environmental review thresholds are met. When required, Massport and Airport tenants submit Environmental Notification Forms (ENF) and Environmental Impact Reports (EIR) pursuant to MEPA. Similarly, where National Environmental Policy Act (NEPA)[3] environmental review is triggered, projects are reviewed under the Federal Aviation Administration (FAA) environmental review process.

Analysis Framework for the 2011 ESPR

Massport has adopted a new, long-term forecast for the long-range planning horizon, 2030. Previous forecasts for the *1999 ESPR* and the *2004 ESPR* forecasts anticipated that Logan Airport would be handling 37.5 million annual passengers in 2015 and 42.8 million passengers in 2020, respectively. The *2011 ESPR* provides an opportunity to revisit previous forecasts and revise them based on current and predicted conditions, and to consider a more distant time horizon. For this *2011 ESPR*, Massport updated the Logan Airport long-range forecast with 2015, 2020, and 2030 as the forecast years. Three scenarios were also developed (Low, Moderate, and High). Massport views the Moderate forecast scenario as the most likely forecast of future activity levels at Logan Airport. Massport's forecast under the Moderate scenario predicts that there will be 39.8 million passengers using Logan Airport in 2030. The updated forecast takes into account slower-than-anticipated passenger growth (compared to previous forecasts), the increasing efficiency of aircraft (higher passenger load factors), and fleet mix trends, including a growing prevalence of larger capacity jet aircraft.

This *2011 ESPR* examines both airside and landside activities, including planned Massport projects, and projects being carried out by others that affect the Airport, such as the FAA's Boston Logan Airport Noise Study (BLANS). Future year projections incorporate available information about projects that have undergone or are currently under MEPA review.

Cumulative analysis of airport activities are based on actual and projected passenger activity levels, aircraft operations, and the facilities and services needed to serve them. Analysis conditions for current and future years are used to assess environmental conditions and to develop, evaluate, and adjust environmental management actions.

Technical Analyses

Table 1-1 summarizes the technical analyses conducted for this *2011 ESPR.* The technical and environmental analyses of 2030 are based on the forecast of 39.8 million passengers using Logan Airport in 2030. Further information on the 2030 environmental analyses is provided in detail within subsequent chapters.

3 42 USC Section 4321 et seq. The Federal Aviation Administration implements NEPA through *Federal Aviation Administration Order 1050.1E, Environmental Impacts: Policies and Procedures*, Federal Aviation Administration, United States Department of Transportation, Effective Date: March 20, 2006.

Table 1-1	2011 Logan Airport ESPR Summary of Technical Analyses, 2011 and 2030		
Chapter	**Technical Analyses**	**2011**	**2030**
Ground Access	■ Mode Share Analysis	X	
	■ Traffic Volumes	X	X
	■ Parking Conditions	X	X
	■ Vehicle Miles Traveled	X	X
	■ Passenger Ground Access Survey (2010)	X	
Noise	■ Aircraft Operations	X	X
	■ Runway Use	X	X
	■ Noise Contours	X	X
	■ Population Counts	X	X
	■ Cumulative Noise Index	X	
	■ Dwell and Persistence	X	
	■ Time-Above Analysis	X	
	■ Preferential Runway Advisory System (PRAS) Program Compliance	X	
	■ Sound insulation program	X	
Air Quality	■ Emissions Inventory	X	X
	■ Greenhouse Gas Inventory	X	X
	■ Nitrogen Dioxide (NO_2) Monitoring	X	
	■ NO_x emissions (AQI)	X	
Water Quality	■ National Pollutant Discharge Eliminations System (NPDES) permit monitoring results	X	
	■ Fuel Spill reporting	X	

Overview of Logan Airport

Logan Airport is New England's primary domestic and international airport, operating as an origin-destination airport, rather than a connecting hub for major airlines. The Airport plays a key role in the metropolitan Boston and New England passenger and freight transportation networks and is a significant contributor to the regional economy. In 2011, Logan Airport employed approximately 14,000 people, including approximately 970 Massport jobs. The Aeronautics Division of the Massachusetts Department of Transportation (MassDOT) *Statewide Airport Economic Impact Study* found that in 2010, Logan Airport supported over 94,000 jobs in Massachusetts and the total economic impact is now estimated at approximately $8.9 billion per year. The total economic impact includes on-airport, visitor-related, construction, and all associated multiplier impacts.[4] In 2011, Logan Airport was the 18th busiest commercial aviation facility in North America ranked by aircraft operations, and the 20th busiest in North America ranked by number of passengers.[5]

4 MassDOT Statewide Airport Economic Impact Study, December 20, 2011.
5 *ACI-NA Airport Traffic Reports 2011 at* http://www.aci-na.org/content/airport-traffic-reports *accessed August 2012.*

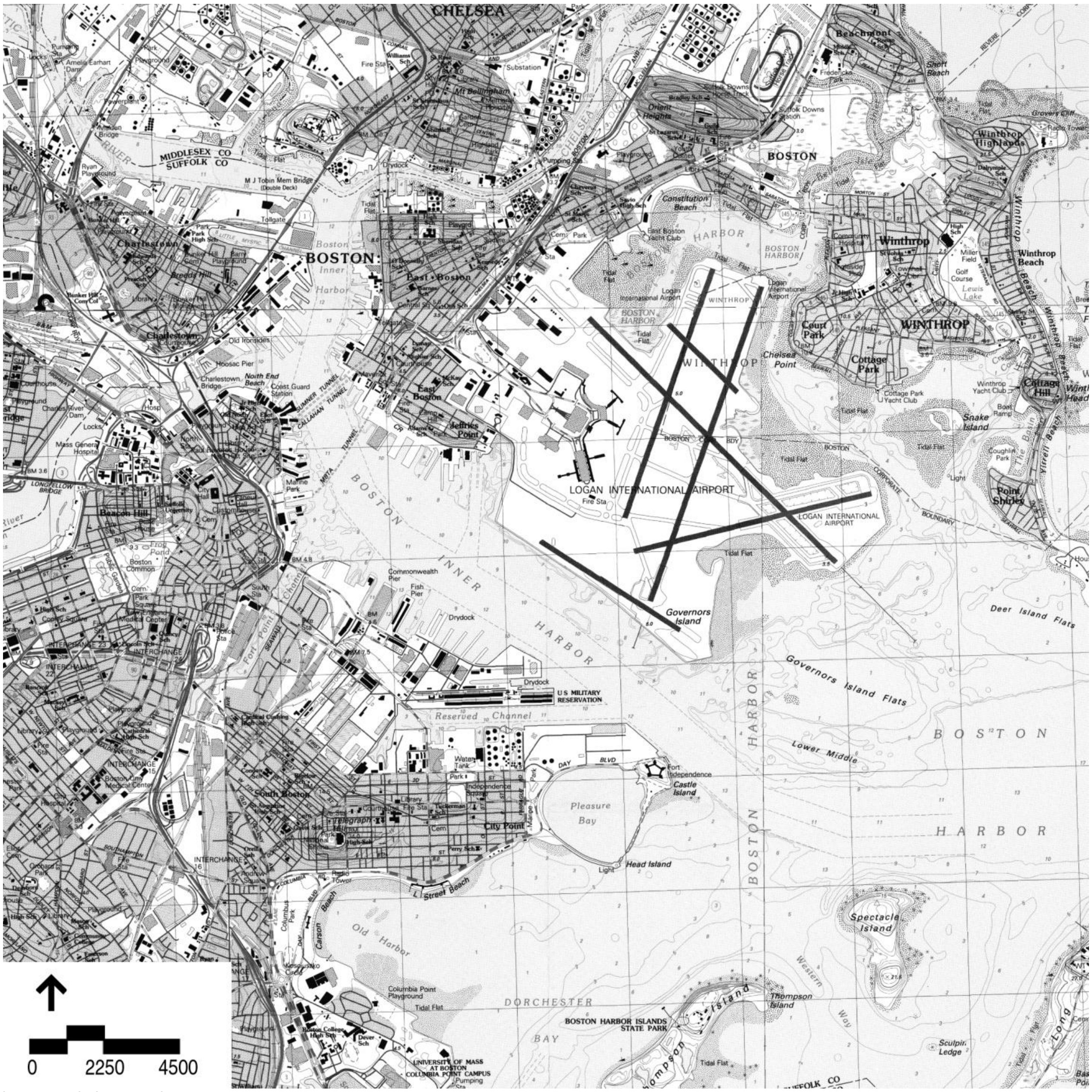
The Airport boundary encompasses approximately 2,400 acres in East Boston and Winthrop, including 700 acres underwater in Boston Harbor. Logan Airport, shown in Figures 1-1 and 1-2, is one of the most land-constrained airports in the nation and is surrounded on three sides by Boston Harbor.

Logan Airport is close to downtown Boston and is accessible by public transit and a well-connected roadway system. The airfield comprises six runways, approximately 15 miles of taxiway, and approximately 240 acres of concrete and asphalt apron. Logan Airport has four passenger terminals (Terminal A, B, C, and E), each with its own ticketing, baggage claim, and ground transportation facilities. Massport continues to evaluate and implement enhancements to Logan Airport's security, operational efficiency, and accessibility to and from the Boston metropolitan area, while carefully monitoring the environmental effects of Logan Airport operations.

Figure 1-1 Aerial View of Logan Airport

Source: Aerial photo, Massport.

Figure 1-2 Logan Airport and Environs



Source: U.S. Geological Service.

Highlights and Accomplishments

This section provides a brief overview of key events and accomplishments at Logan Airport in 2011 and a prediction of 2030 environmental conditions where appropriate. Additional information concerning Airport activities is provided in subsequent chapters. Massport's efforts to further sustainability through specific projects and initiatives are highlighted with a sustainability leaf.

Activity Levels

Highlights in aviation activity at Logan Airport in 2011 include the following:

- The total number of air passengers at Logan Airport increased by 5.4 percent to 28.9 million, compared to 27.4 million in 2010 (see Figure 1-3). Previously, annual air passengers at the Airport increased by 7.5 percent between 2009 and 2010. Passenger levels in 2011 represent a new record, exceeding the 2007 peak of 28.1 million annual air passengers. In 2000, Logan Airport accommodated 27.7 million air passengers.
- The total number of aircraft operations[6] grew from approximately 352,640 in 2010 to 368,990 in 2011, an increase of 2.1 percent. Aircraft operations at Logan Airport in 2011 remained well below the 487,996 operations peak in 2000 and the historic peak achieved in 1998. Passenger aircraft operations, which accounted for 91 percent of total aircraft operations, increased by 0.8 percent compared to 2010 levels.
- General aviation[7] (GA) operations, which accounted for 8 percent of total operations, increased by 92.3 percent over 2010 levels. This marked a strong recovery in GA activity at Logan Airport as a result of improving economic conditions, following steep declines in GA operations from 2008 to 2009 due to the economic recession. The 28,230 GA operations in 2011 were still below the GA levels in 2000, which totaled 35,233 GA operations.
- There were 6,270 dedicated air cargo operations at Logan Airport in 2011, which represents a decline of 0.1 percent compared to the previous year. All-cargo operations have fallen by nearly 50 percent since 2000 when Logan Airport accommodated 12,282 air cargo operations.
- The number of air passengers per aircraft operation continued to increase, climbing from an average of 77.8 passengers per aircraft operation in 2010 to an average of 78.3 passengers per aircraft operation in 2011, reflecting even greater efficiency. This compares to 56.8 passengers per operation in 2000.
- Legacy air carriers maintained tight capacity discipline, while low-cost carriers (LCCs) increased operations. Legacy carriers continued to reduce domestic operations slightly in 2011, eliminating less profitable routes. In contrast, LCC operations have steadily increased. LCCs accounted for 32.5 percent of domestic operations at Logan Airport in 2011, compared to 28.6 percent in 2010, 9.0 percent in 2003 prior to JetBlue Airways' entry, and just 2.9 percent in 2000.
- Air cargo volumes, including shipments transported in the belly compartments of passenger aircraft, decreased from 572 million pounds in 2010 to 555 million pounds in 2011, a decline of 3.1 percent. In comparison, Logan Airport's air cargo volume exceeded 1 billion pounds in 2000. Table 1-2 provides a snapshot of the changes in air passengers, aircraft operations, and cargo and mail volume levels from 2000 to 2011.

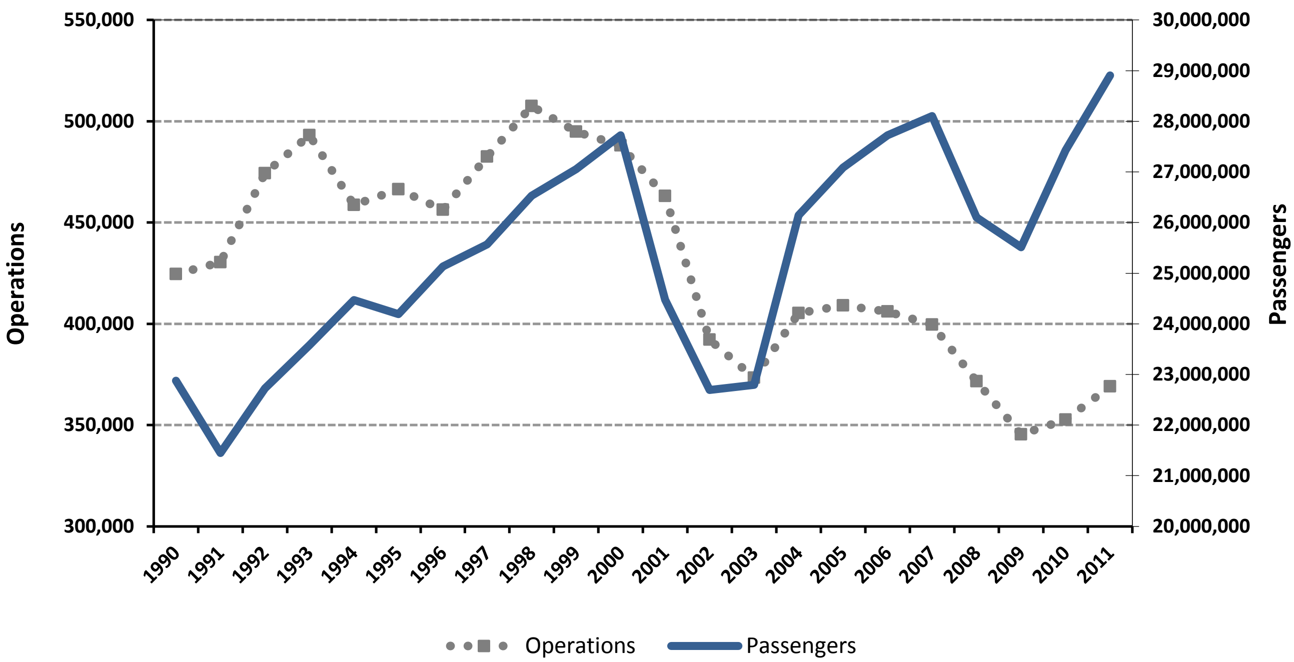
6 An aircraft operation is defined as one arrival or one departure.
7 General Aviation (GA) is defined as all aviation activity other than commercial airline and military operations.

Table 1-2 Air Passengers, Aircraft Operations, and Cargo and Mail Volume, 2000 to 2011

	2000	2001	2002	2003	2004	2005	2006
				Air Passengers by Market Segment			
Domestic	23,100,645	20,070,039	18,725,422	18,890,079	21,830,294	22,728,788	23,556,382
International	4,513,192	4,301,250	3,882,257	3,815,987	4,201,638	4,237,105	4,049,595
General Aviation	112,996	103,641	88,462	85,103	110,584	122,012	119,466
Total Passengers	27,726,833	24,474,930	22,696,141	22,791,169	26,142,516	27,087,905	27,725,443
				Aircraft Operations by Market Segment			
Total Aircraft Operations	487,996	463,124	392,079	373,304	405,259	409,067	406,119
Total Passenger Operations	440,481	423,067	356,469	335,022	364,434	367,502	365,684
Total GA Operations	35,233	28,739	25,596	28,660	31,236	32,652	31,444
Total Cargo Operations	12,282	11,318	10,014	9,622	9,589	8,913	8,991
				Cargo and Mail Volume (lbs.)			
Total Volume	1,047,249,667	871,251,376	855,452,835	802,595,280	807,686,996	785,245,722	716,337,833
	2007	**2008**	**2009**	**2010**	**2011**	**Pct. Change (2000-2011)**	**Avg. Annual Growth (2000-2011)**
				Air Passengers by Market Segment			
Domestic	23,837,727	22,032,246	21,767,086	23,688,471	24,831,068	4.8%	0.7%
International	4,153,442	3,977,297	3,696,336	3,681,739	3,962,454	7.6%	(1.2%)
General Aviation	111,286	93,108	48,664	58,752	114,416	94.7%	0.1%
Total Passengers	28,102,455	26,102,651	25,512,086	27,428,962	28,907,938	5.4%	0.4%
				Aircraft Operations by Market Segment			
Total Aircraft Operations	399,537	371,604	345,306	352,643	368,987	4.6%	(2.5%)
Total Passenger Operations	362,298	339,115	326,406	331,687	334,487	0.8%	(2.5%)
Total GA Operations	28,632	23,820	12,242	14,682	28,230	92.3%	(2.0%)
Total Cargo Operations	8,607	8,669	6,658	6,274	6,270	(0.1%)	(5.9%)
				Cargo and Mail Volume (lbs.)			
Total Volume	658,293,141	621,283,399	546,359,548	572,283,608	554,618,648	(1.9%)	(16.9%)

Source: Massport.

Figure 1-3 Historical Passenger and Operations Activity Levels at Logan Airport, 1990-2011



Source: Massport.

The forecast aviation activity in 2030 includes the following highlights:

- The total number of air passengers at Logan Airport is projected to increase by 1.7 percent annually and reach 39.8 million in 2030. Domestic passengers are forecast to be 32.1 million, an increase of 1.4 percent per year, while international passengers are forecast to be 7.6 million, an increase of 3.5 percent per year.
- GA passenger traffic is forecast to remain relatively stable over the forecast period at approximately 108,000 passengers.
- Aircraft operations are forecast to increase at a slightly slower rate than passenger traffic, growing by 1.3 percent per year. By 2030, Logan Airport is forecast to accommodate 474,734 annual aircraft operations. Passenger airlines are expected to account for nearly 93 percent of total aircraft operations at Logan Airport in 2030.
- In 2000, there were 487,996 operations with 27.7 million passengers as compared to projected operations of 474,734 and annual passengers of 39.8 million in 2030.
- The projected fleet mix for Logan Airport reflects a continuation of airline industry fleet trends that include movement into larger capacity jet aircraft, a reduction in small regional jet (RJ) aircraft and increases in larger RJs and turboprops, which have more favorable operating costs in a high fuel price environment. At Logan Airport, the passenger airline aircraft fleet mix is expected to shift towards larger capacity jet aircraft. As a result of the expected shifts in the fleet mix and slightly higher passenger load factors, the average number of passengers per passenger airline operation is predicted to rise from 78 in 2011 to 84 in 2030.

Planning

The status of Airport projects in 2011 and 2012 is provided below.

- **Southwest Service Area (SWSA) Redevelopment Program (EEA 14137).** Massport completed the permitting for redeveloping the SWSA at Logan Airport, including a new consolidated rental car facility (ConRAC). Consolidation of the rental car operations and their shuttle buses into a single coordinated shuttle bus fleet operation will result in customer service improvements, environmental management enhancements, reduced vehicle miles traveled (VMT) and the associated reductions in air emissions. ConRAC construction began in July 2010, starting with various enabling phases of construction and will be completed in 2014.
- **Logan Runway Safety Area (RSA) Improvements Project at Runway Ends 33L and 22R (EEA 14442).** The safety improvements are required to enhance the RSAs, to the extent feasible, to be consistent with the FAA's current airport design criteria for RSAs and to enhance rescue access in the event of an emergency. As an older airport, Logan Airport was constructed before many of the current safety standards were developed and several of the runways currently end at the water's edge. The RSAs enhancements that are currently under construction are safety improvements and do not extend runways; nor they do have any effect on normal runway operations, runway capacity or types of aircraft that can use the runways. Construction of the Runway 33L RSA improvements commenced in June 2011 and was completed ahead of schedule in November 2012. The Runway 22R RSA improvements will be completed by the end of 2015. The status of mitigation for the RSA projects is provided in *Chapter 9, Project Mitigation Tracking*. As of this filing, mitigation efforts associated with Runway 33L safety improvements are underway.
- **Logan Runway 33L Light Pier Replacement Project (EEA 14442).** In January 2012, Massport submitted a Notice of Project Change (NPC) to the RSA Project (noted above) to include full replacement of the Runway 33L Light Pier, including all sections not already replaced by the Runway 33L RSA Project. All local, state and federal permits were secured in 2012 and the replacement was completed in November 2012 coinciding with the completion of the Runway 33L RSA Project. As part of this project, the Runway 33L Instrument Landing System (ILS) approach was upgraded from CAT I to CAT III. FAA approved and published the aRea NAVigation (RNAV) procedure on March 7, 2013.
- **Green Bus Depot (EEA 14629).** Design of a bus maintenance facility for Massport's clean fuel fleet buses in the North Service Area (NSA) began in 2009. The Green Bus Depot will help to minimize bus traffic on local streets by serving as a central location for bus maintenance on Airport property rather than traveling for service at the off-site bus maintenance location in Chelsea. The Green Bus Depot is used to maintain the expanded clean fuel shuttle bus fleet that replaced Logan Airport's compressed natural gas (CNG) bus fleet and will maintain the rental car company diesel shuttle buses when the ConRAC opens. Construction was completed in September 2012 and the facility is now in operation.
- **East Boston-Chelsea Bypass Project (EEA 14661).** The Bypass is a limited access roadway between Logan Airport and the new Chelsea Street Bridge. The Bypass roadway is designed to improve commercial vehicle access to the Airport, as well as reduce congestion on local East Boston streets in the vicinity of Day Square, Eagle Square, and the Neptune Road corridor by directing Airport-related commercial traffic to the new Bypass roadway. Construction was substantially completed in November 2012 and the roadway is open to Airport-related commercial service. The road was named the "Martin A. Coughlin" Bypass Road for the late Martin A. Coughlin, an East Boston resident. The project includes the use of high efficiency light-emitting diode (LED) lighting and incorporates bio-swales for stormwater retention and drainage.

- **Logan Airport Economy Parking Garage Project.** Construction of the Economy Parking Garage began in the summer of 2010 and was completed and fully opened to the public in early 2011. Sustainable features installed as part of this project included: solar panel "trees" on the garage roof, energy-efficient lighting, and trellis plantings with vines on the public edge of the garage façade.
- **North Service Area (NSA) Roadway Corridor Project.** The NSA Roadway Corridor extends approximately from the State Police building up to and including Neptune Road. This corridor improvement project is intended to unify the existing roadway with new landscape and urban design elements along this highly visible roadway corridor, providing an important public edge along the corridor. Massport recently installed a WindWheel Sculpture by William Wainwright on a parcel southwest of Neptune Road. Construction of the NSA Roadway Corridor Project began in 2010 and was completed in the spring of 2012.
- **Greenway Connector Project.** The Greenway Connector is a pedestrian/bicycle path connecting the Bremen Street Park path to the City of Boston pedestrian/bicycle path that begins at the Greenway Overlook and continues to Constitution Beach. When completed, the Greenway and the City of Boston Link will provide a continuous pedestrian/bicycle path from Piers Park to Constitution Beach. Construction of the Greenway Connector is planned to begin in the spring of 2013.
- **Hangar Upgrade Projects.** Architectural designs commenced in December 2010 for two hangar upgrades in the North Cargo Area (NCA) and are scheduled for completion in 2013. The renovated JetBlue Airways hangar opened in 2012.
- **Renovations and Improvements at Terminal B.** This project includes renovations to Terminal B, Pier A. By modifying and expanding existing facilities to meet airlines' needs and providing a connection between Piers A and B, the project improves and simplifies the passenger traveling experience. With initial renovations beginning in June 2012, the project is expected to be completed by 2014.
- **Terminal B Garage Improvement Project.** Terminal B Garage repair and rehabilitation was completed in March 2012. In addition to overall upgrades, sustainable features were also installed including 32 solar panel trees (200 kilowatt (kW)) on the top floor, LED lighting throughout the garage, and two rainwater harvesting collection tanks to store and later recycle stormwater.

Regional Transportation

Overall, aviation activity at New England's regional airports increased in 2011, as the regional airports experienced a modest recovery after the 2008/2009 Economic Recession. Highlights for the regional airports and the status of long-range regional transportation planning efforts in the region which are relevant to Massport's three airports as well as the regional transportation network are provided below.

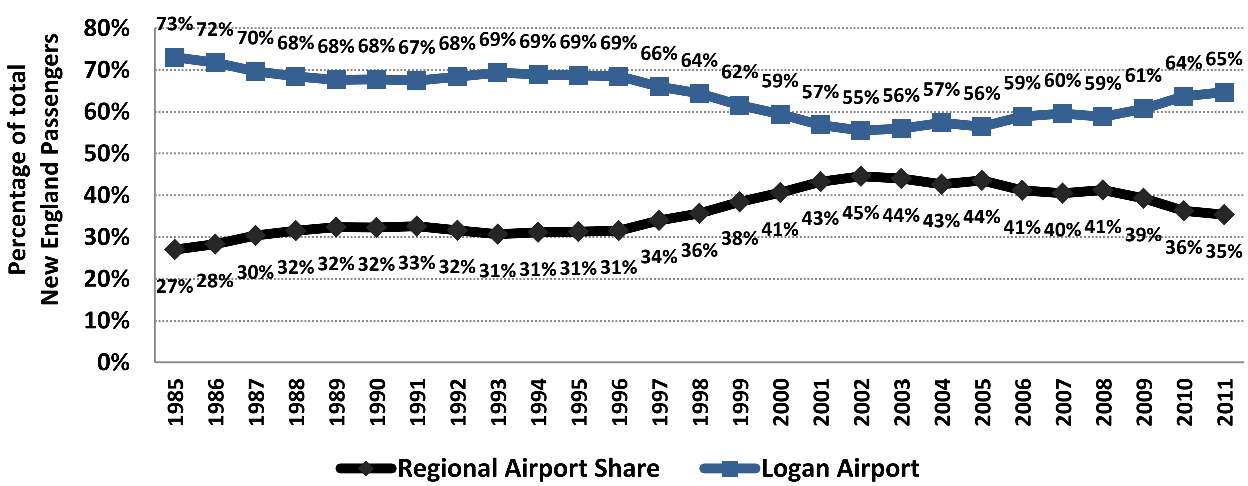
- The total number of air passengers utilizing New England's commercial service airports, including Logan Airport, increased from 43.1 million in 2010 to 44.7 million annual air passengers. This represents an annual increase of 3.8 percent, which exceeds the overall average increase of 1.7 percent in the U.S. passenger market in 2011.[8] In comparison, the total number of air passengers utilizing New England's commercial service airports was 46.7 million in 2000 and 45.6 million in 2004. The decline in passenger traffic at the regional airports reflects the challenging operating environment facing U.S. airlines since the global economic downturn that began in 2008 and is consistent with the national trend at secondary and tertiary airports.
- The challenging airline operating environment has continued to affect smaller communities disproportionately. Within the region, Logan Airport passenger traffic grew considerably faster than air passenger levels at the other regional airports. Of the 44.7 million air passengers using New England's commercial service airports in 2011, 64.7 percent of air passengers (28.9 million) used Logan Airport

8 Airports Council International, 2011 Worldwide Air Traffic Report.

compared to a low of 55.5 percent (22.7 million) in 2002 (see Figure 1-4). Despite the recent increases in Logan Airport's regional share, it remains well below a high of 73 percent in 1985.[9] Passenger levels at the regional airports increased by 1.1 percent (0.2 million) in 2011, compared to an increase of 5.4 percent at Logan Airport. This trend reflects a slow recovery at the regional airports following the recent service cuts by legacy air carriers and LCCs in these smaller secondary markets. Growth at Logan Airport has been driven by the continued expansion of LCC service, in particular JetBlue Airways.

- Aircraft operations in the New England region increased by 2.1 percent, from 1.07 million operations in 2010 to 1.09 million operations in 2011. Commercial airline operations remained largely flat, increasing by 0.8 percent (4,932 operations), while GA increased by 4.3 percent (17,827 operations) due primarily to a recovery in GA activity since the 2008/2009 economic recession. Military operations decreased by 1.4 percent (483 operations). While aircraft operations in the region increased slightly in 2011 compared to 2010, aircraft operations have declined significantly since 2000. Total regional aircraft operations fell by nearly one third, from 1.6 million in 2000 to 1.1 million in 2011.
- Massport continued to engage in metropolitan cooperative planning efforts including GreenDOT, the Healthy Transportation Compact, and the Boston Metropolitan Planning Organization (Boston MPO).[10,11]
- Massport is participating in the development of MassDOT's first statewide strategic multi-modal, long-range transportation plan known as *weMove Massachusetts*.[12] The goal of *weMove Massachusetts* is to build action-oriented policies based on stakeholder feedback to implement priorities for the present and future needs of the Massachusetts transportation system.
- Massport is cooperating with MassDOT's efforts to expand Boston's South Station to meet the current and future demand for rail mobility within Massachusetts and along the Northeast Corridor.

Figure 1-4 Regional Airports' Share of New England Passengers, 1985-2011



Source: Massport and individual airport data reports.

9 Based on airport passenger statistics from 1985 to 2011.
10 Massachusetts Department of Transportation, www.eot.state.ma.us/default.asp?pgid=content/releases/pr060210_GreenDOT&sid=release, June 2, 2010.
11 Massachusetts Department of Transportation, www.massdot.state.ma.us/main/healthytransportationcompact.aspx.
12 Using an analytical approach developed for the *WeMove Massachusetts* process, MassDOT can prioritize transportation investments for different planning scenarios based on national standards and available funds. *WeMove Massachusetts* provides performance measures of critical transportation investments. Massachusetts Department of Transportation, Office of Transportation Planning. http://www.massdot.state.ma.us/wemove/ (Accessed November 2012).

Ground Access to and from Logan Airport

Key findings for on-Airport transportation include:

- The total number of annual air passengers at Logan Airport increased 5.4 percent to 28.9 million, compared to 27.4 million in 2010. During the same period, average daily traffic on Airport roadways increased by 5.6 percent from 94,179 vehicles per day in 2010 to 99,449 vehicles per day in 2011 (refer to Table 1-3). Even with almost a million additional passengers, traffic volumes remained lower than those experienced in the mid-decade years. In 2007, which was the most comparable year to 2011 in terms of overall Airport passengers activity levels in the last decade, the average daily traffic was 110,690 vehicles per day, or 10 percent higher than 2011 levels.[13]
- Massport began using an updated, more detailed, micro-simulation tool to model, calculate and analyze VMT on the Airport roadway system. The new model (VISSIM) calculated a VMT increase of 2.9 percent from 2010 to 2011. Using the previous model would have shown a 5.7 percent increase in VMT. This difference can be attributed to the new model having better calibration of on-Airport mode share among different users and reflecting more accurate roadway geometry.
- Similar to the trend in traffic volumes, VMT has shown an overall decline in comparison to the number of air passengers at Logan Airport. The average weekday VMT was 7 percent higher in 2007 than 2011 levels, although there were 800,000 fewer air passengers using the Airport in 2007.[14]
- The number of vehicles that parked on-Airport (measured by the revenue parking exits) increased by nearly 4 percent from 2,582,453 in 2011 compared to 2,494,019 in 2010, but remained well below historic high levels. (In the past 12 years, the highest level was recorded in 2000 at 3,423,118 parked vehicles.) Massport was in compliance with the Logan Airport Parking Freeze throughout 2011.

Key findings for ground access activity include:

- Massachusetts Bay Transportation Authority (MBTA) Silver Line bus boardings at the Airport continued to grow, increasing by over 8 percent in 2011, while Blue Line transit boardings at Airport Station remained relatively level compared to 2010. MBTA ridership on the Blue and Silver Lines has been increasing steadily over the past several years, increasing over 50 percent since 2007.
- In the summer of 2012, Massport initiated a pilot program that allowed passengers free boarding on the Silver Line at Logan Airport. (The program also entailed added customer service staff during peak arrivals periods during the summer and increased public transportation signs and wayfinding.) The promising results of this program showing reduced dwell times and faster travel times through the terminal area, which resulted in extension of the free-fare program through June 1, 2013.
- In 2011, ridership on all types of water transportation to the Airport increased by about 3 percent in comparison to the previous year. However, ridership on the MBTA ferry has been decreasing steadily over the last several years. Overall ridership on water transportation has decreased 16 percent since 2007 with most of the ridership loss occurring on the MBTA ferry service, while there has been a slight increase in water taxi use since 2007.
- In 2011, air passenger ridership using Logan Express bus service increased about 1 percent compared to 2010 levels, whereas employee use of Logan Express increased by almost 15 percent, from 467,020 in 2010 to 536,513 employee passengers in 2011. Since 2007, there has been a decrease in air passenger ridership on Logan Express (147,921 fewer passengers or a 19 percent decrease). However, this has been counter-balanced by increased employee use (132,291 more employees or a 33 percent increase) keeping

13 In 2007, there were 28,102,455 air passengers at Logan Airport, approximately 800,000 fewer than in 2011, in which there were 28,907,938 air passengers.
14 Comparison of 2007 and 2011 used the previous VMT model for year over year comparison accuracy.

overall Logan Express ridership steady since 2007. Employee ridership now accounts for about 45 percent of the service's total ridership.

- Limousine/shared-ride van ridership increased by an estimated 10 percent, and taxi dispatches increased 6 percent in 2011 compared to 2010. After showing some declines in limousine ridership during the Economic Recession of 2008/2009, it has since rebounded, showing an overall increase of 8 percent since 2007 levels.

Table 1-3 Logan Airport Gateways: Annual Average Daily Traffic, 2000 - 2011

	AADT		AWDT		AWEDT		Annual Air Passengers	
Year	Volume	Percent Change	Volume	Percent Change	Volume	Percent Change	Level of Activity	Percent Change
2000	95,058	3.8%	101,446	3.9%	78,358	2.1%	27,412,926	1.3%
2001	86,811	(8.7%)	91,588	(9.7%)	74,911	(4.4%)	24,474,930	(11.7)%
2002	84,927	(2.2%)	89,731	(2.0%)	73,398	(2.0%)	22,696,141	(7.3%)
2003 [1,2]	88,978	4.8%	*93,680*	4.4%	*77,239*	5.2%	22,787,169	0.4%
2004	100,206	12.6%	106,278	13.4%	84,950	10.0%	26,142,516	14.7%
2005	106,000	5.8%	112,600	6.0%	89,400	5.2%	27,087,905	3.6%
2006 [3]	NA	NA	NA	NA	NA	NA	27,725,443	2.4%
2007	110,690	4.4%	119,200	5.9%	91,320	2.1%	28,102,455	1.4%
2008	96,187	(13.1%)	100,107	(16.0%)	80,797	(11.5%)	26,102,651	(7.1%)
2009	89,575	(6.9%)	93,670	(6.4%)	78,905	(2.3%)	25,504,845	(2.3%)
2010	94,179	5.1%	98,968	5.7%	82,595	4.7%	27,428,962	7.5%
2011	**99,449**	**5.6%**	**104,863**	**6.0%**	**85,879**	**4.0%**	**28,907,938**	**5.4%**

Source: Massport
Notes: Numbers in parentheses () represent negative numbers.
1 For years between 1999 and 2003, total gateway volumes are adjusted to eliminate TWT- Route 1A through traffic not destined to or from Logan Airport.
2 Based on a ratio of AADT/AWDT from previous years and based on a ratio of AWEDT/AWDT from previous years.
3 Gateway traffic volumes were not collected in 2006 due to the temporary closure of the Ted Williams Tunnel.
AADT Annual average daily traffic.
AWDT Annual average weekday daily traffic.
AWEDT Annual average weekend daily traffic.
NA Information Not Available.

Key findings for ground transportation mode shares include:

- The *2010 Logan Airport Air Passenger Ground-Access Survey* indicates that share of high-occupancy vehicles (HOV) modes to the Airport has returned to 2004 levels (at 30 percent HOV mode share). This represents a 2 percent increase in share from the levels reported in the *2007 Air Passenger Ground Access Survey*.
- Logan Airport continues to rank among the top U.S. airports with respect to HOV/transit/shared-ride mode share. It is useful to note, however, that there is no standard aviation industry definition with respect to categorizing ground access modes as HOV versus SOV. While some modes (e.g., Logan Express and the Silver Line) clearly fall into the HOV mode category, the proper category for a limo or taxi is less clear. For example, if Logan Airport ground access mode shares were recalculated using the same category definitions as are used by San Francisco International Airport (SFO), the Logan Airport HOV mode share would exceed 40 percent, ranking Logan Airport higher than SFO for HOV mode share.
- Moreover, many private passenger vehicles arrive at Logan Airport with several occupants. In fact, the 2010 survey indicates that 69 percent of private vehicles carried two or more air passengers, for an average of 2.3 air passengers per private vehicle. Thus, to be consistent with current transportation planning practice, vehicle occupancy would serve as a more representative measure of ground access activity and mode

choices. If access mode shares were defined based on occupancy, Logan Airport's HOV share of access trips would be 71 percent.

Key findings for the 2030 VMT and parking demand projections include:

- Annual air passenger levels are predicted to increase 37.8 percent or to 39.8 million by 2030. A 20 percent increase in VMT is projected by 2030. This is compared to a nearly 9 percent decrease in VMT realized over the past 10 years (even as annual air passenger levels in 2000 and 2010 were about the same.
- Peak parking demand (the number of spaces needed to accommodate parked vehicles on the peak day of the year) at Logan Airport is already at practical parking capacity level. Thus, as air passenger levels increase, as suggested by the 2030 forecasts, Massport will not be able to accommodate the potential additional parking demand on-Airport with the existing Logan Airport Parking Freeze in place. Much of this travel demand to the Airport will have to occur via other modes. The challenge is how to influence a shift so that the passengers generating the excess parking demand are encouraged to use sustainable HOV transportation modes rather than increasing taxi or private vehicle drop-off and pick-up activity that would generate unacceptable levels of curbside congestion (and associated emissions). Recent analyses suggest that by constraining parking at Logan Airport, vehicle trips to the Airport would increase in the form of curbside drop-offs by taxis and private vehicles. This is a key planning issue that Massport will address in future airport-wide strategic planning efforts.

Noise Abatement

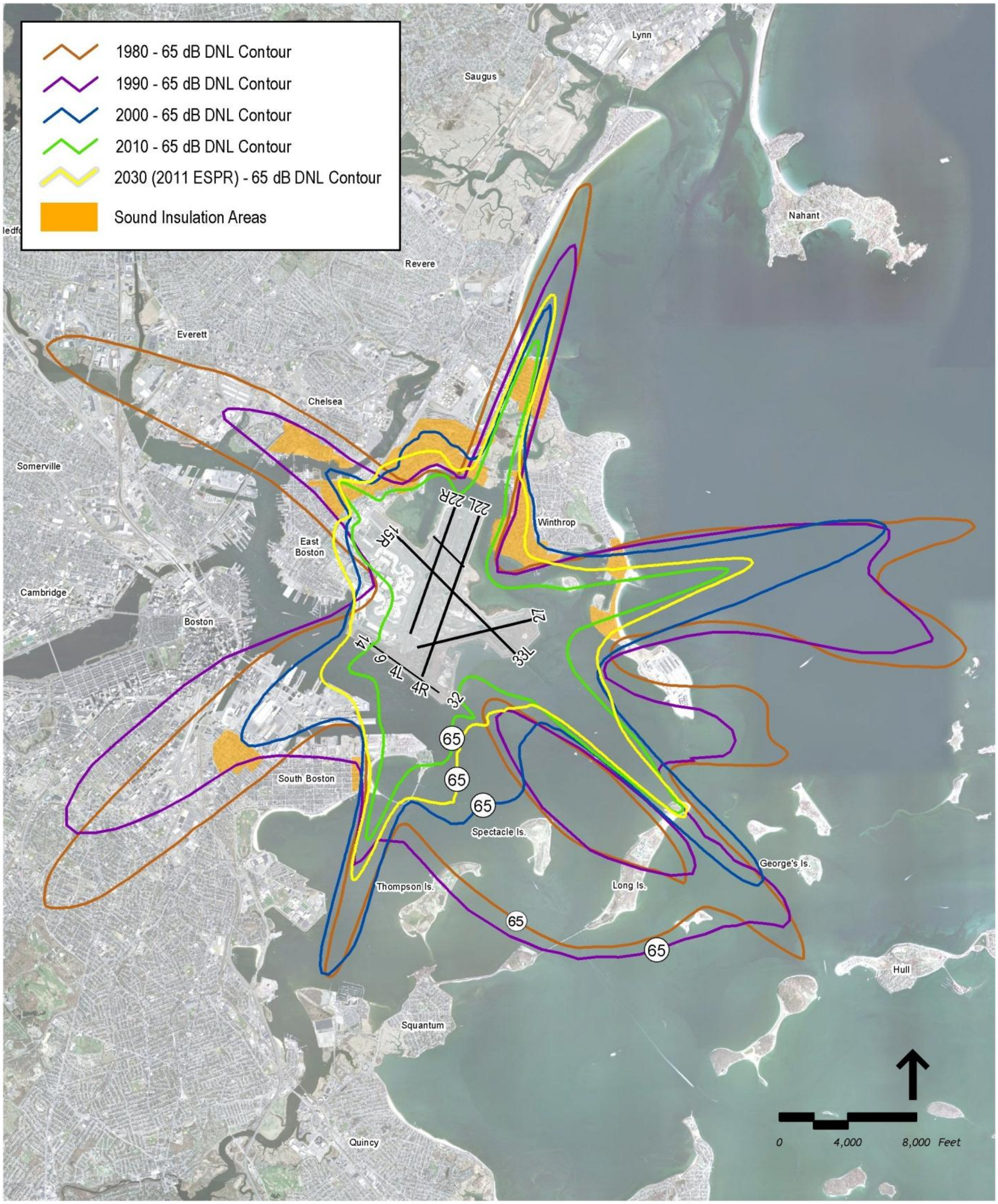
In 2011, the following changes occurred in the Airport noise environment:

- Compared to 2010, the 2011 DNL decibel (dB) contours were smaller in East Boston and over Boston Harbor toward Hull. The DNL 65 dB contour was slightly larger in Revere, South Boston, and in most of Winthrop for 2011. There are several factors that influenced the contour changes, including:
  - Runway 15R-33L, which is the nighttime noise abatement runway, was temporarily closed from July through September and during the daytime in June, October and November of 2011 to allow for construction of the enhanced Runway 33L RSA. Typically, this runway is used during these periods for head to head operations (arrivals to Runway 33L and departures from Runway 15R) at night, which keeps air traffic over Boston Harbor.
  - During the Runway 15R-33L closure period, night operations primarily used Runway 22R and Runway 9 for departures and Runway 4R and 22L for arrivals.
  - The Runway 15-33L closure resulted in the reduction in noise levels in East Boston and the slight increase in noise levels in Revere and Winthrop.
- The overall number of people exposed to DNL values greater than 65 dB increased to 3,947 people in 2011 from 3,830 people in 2010 (an increase of 117 people).[15] The number of people residing within the DNL 70 dB contour remained at 130 people. These levels are well below the numbers of people exposed in the year 2000 when 17,745 people were exposed to DNL noise levels greater than 65 dB and 1,551 people were exposed to DNL levels greater than 70 dB.
- In 2011, Massport provided sound insulation to 114 homes, 84 percent of which were in Chelsea. The focus of the program in Chelsea was to fulfill federal and state mitigation commitments related to the opening of Runway 14-32. Since the inception of Massport's residential sound insulation program (RSIP), 11,333 homes have received sound insulation treatment in East Boston, South Boston, Winthrop, Revere, and Chelsea.

15 Population data was derived from the most recent 2010 United States (U.S.) Census.

Based on the 2030 forecast of aircraft operations and expected aircraft fleet mix, the following conditions are expected in 2030:

- There is forecast to be a larger number of operations and a higher percent jet fleet than in 2011. The higher level of operations is not a capacity challenge as the Airport has operated in the past with over 1,300 operations per day. For example, there were 1,355 operations per day in 2000 when there were only five runways instead of the current six.
- The 2030 fleet mix consists of 81 percent commercial jets whereas the 2011 fleet mix consists of 78 percent commercial jets. The 2000 fleet mix had a lower proportion of commercial jets at 62 percent of the fleet.
- Total operations are expected to increase by 29 percent or 290 operations per day from 2011 to 2030, from 1,011 operations per day in 2011 to 1,301 operations per day in 2030. Compared to 2000, which is the last year that Logan Airport had over 1,300 daily operations, 2030 is forecasted to have 54 fewer daily operations (1,355 in 2000 and 1,301 in 2030). Daytime commercial operations are projected to increase by 254 operations per day from 819 in 2011 to 1,073 in 2030, however this is still fewer than the 1,142 daytime operations in 2000. Nighttime commercial operations are projected to increase from 114 in 2011 to 154 in 2030. This is an increase compared to 2000 when 126 daily operations occurred at night.
- Daytime GA operations are projected to decrease slightly from 71 per day in 2011 to 67 per day in 2030 (a decrease of 6 percent) and nighttime GA operations are projected to also decrease slightly from 6.7 in 2011 to 6.5 in 2030 (a decrease of 3 percent). In 2000, daytime GA operations were significantly higher at 82 daily operations with nighttime GA daily operations slightly lower at 5.7 operations.
- The 2030 forecast assumes the continued use of the highest capacity runway configurations (Runway 4L and 4R for arrivals and Runway 9 for departures and Runway 27 for arrivals and Runway 22L and 22R for departures) consistent with today's runway use. The same higher capacity runway combinations were used in 2000 (78 percent of the arrivals used Runways 4L, 4R, 22L and 27 with 68 percent of the departures on Runways 9, 22L and 22R).
- The 2030 operations forecast produced a larger set of DNL noise contours with the number of people exposed to noise levels greater than DNL 65 dB increasing from 3,947 in 2011 to 12,211 people in 2030. This is still significantly fewer than the number of people exposed in 2000 (17,745 people). The number of people within the DNL 70 dB is also projected to increase from 130 in 2011 to 352 people in 2030 but still remaining well below the 1,551 people within the DNL 70 dB in 2000. All of the residences within the forecasted 2030 DNL 65 dB contour are in areas where Massport has implemented its sound insulation program. Figure 1-5 presents the DNL 65 dB noise contours from every decade starting with 1980 for historical context.



Path: H:\GIS\USAMA\Logan\304280_Logan_2011ESPR\304280_2011ESPR-Historic_DNL_Comparison.mxd

Source: Massport NOMS / ERA Multi-Lat, Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs, U.S. Department of Agriculture, National Agriculture Imagery Program (NAIP) 2010

Comparison of Historical and Forecast 65 dB DNL Contours - 1980, 1990, 2000, 2010, and 2030

Figure 1-5

Air Quality/Emissions Reduction

Air quality conditions in 2011 are described, as follows:

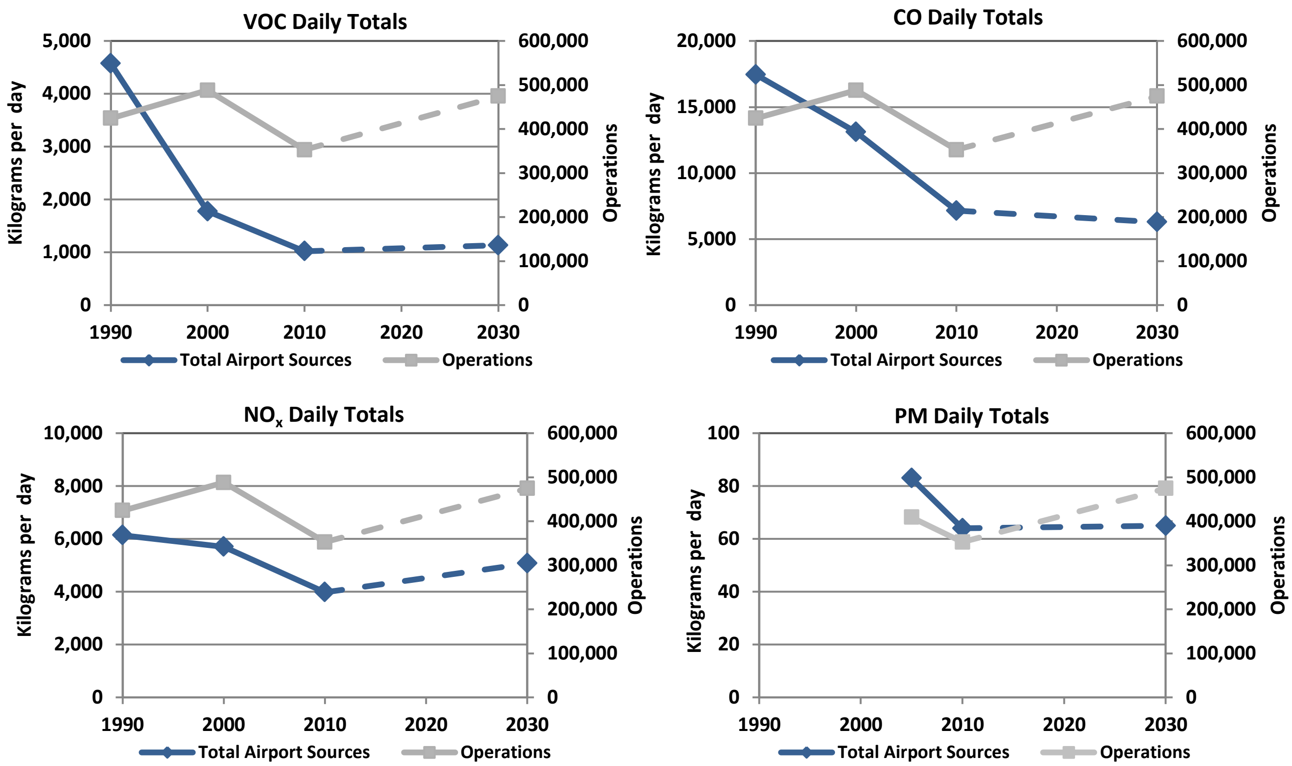
- Total volatile organic compounds (VOC) emissions were 1,109 kilograms per day (kg/day), or 9 percent higher than 2010 levels, but still follow a long-range (i.e., a period of over 20 years) downward trend decreasing by almost 76 percent since 1990. This one-year increase is primarily due to the increase in landing and takeoff operations (LTOs) when compared to 2010 (176,322 LTOs in 2010 and 184,494 LTOs in 2011).
- Total emissions of oxides of nitrogen (NO_X) were 4,077 kg/day, or 2 percent higher than 2010 levels. In 2011, total NO_x emissions at Logan Airport were approximately 29 percent lower than 2000 levels. Also, total NO_x emissions in 2011 were 707 tons per year (tpy) lower than Massport's 1999 Air Quality Initiative (AQI) benchmark. This represents an overall decrease of 30 percent in NO_x emissions since 1999.
- Total emissions of carbon monoxide (CO) were 6,919 kg/day, or 3 percent lower than 2010 levels and 53 percent lower than 2000 levels; following the same long-range downward trend as VOCs and NO_x.
- Total emissions of particulate matter ($PM_{10}/PM_{2.5}$) associated with Logan Airport increased in 2011 by approximately 5 percent to 67 kg/day compared to 2010 levels, but still following a long-range downward trend decreasing by 19 percent since 2005 (2005 is the first year that $PM_{10}/PM_{2.5}$ emissions were reported). This one-year increase is mostly attributable to the corresponding increase in stationary source use, particularly snow melters in conjunction with the unusually heavy snowfall in early 2011.
- Since 1999, there has been a continuing trend of decreasing nitrogen dioxide (NO_2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the vicinity of Logan Airport. In addition, the annual NO_2 concentrations at all monitoring locations in 2011 continued to be well within the National Ambient Air Quality Standards (NAAQS) for NO_2. The NO_2 monitoring program was discontinued in 2012.
- Massport's Air Quality Monitoring Study is now complete, having collected data on a variety of ambient air pollutants over a two-year period as a means of assessing any air quality changes attributable to the operation of the Centerfield Taxiway which was completed in 2009. The findings from this Study will be submitted to MassDEP in 2013, and reported in the next Logan Airport EDR.
- This reporting year, 2011, marks the fifth consecutive year in which Massport has voluntarily prepared a greenhouse gas (GHG) emissions inventory for the EDR/ESPR. The 2011 GHG emission inventory was prepared following methodological guidance by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP).[16] The 2011 inventory assigns GHG emissions based on ownership or control (whether it is controlled by Massport, the airlines or other airport tenants, or the general public). Total Logan Airport GHG emissions in 2011 were 5 percent higher than 2010 levels primarily due to the increase in aircraft operations and passenger vehicles accessing the Airport. Massport-related emissions represent only 12 percent of total GHG emissions at the Airport, tenant-based emissions represent approximately 68 percent, electrical consumption represents 14 percent; and passenger vehicle emissions represent 6 percent. This inventory is one of the three GHG emissions inventories Massport prepares annually; however, the other two only comprise stationary sources of GHGs and are filed with MassDEP and the U.S. Environmental Protection Agency (EPA) respectively.

16 Transportation Research Board, Airport Cooperative Research Program, ACRP Report 11, Project 02-06, *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories*. See http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_011.pdf for the full report.

The emission trends for VOCs, NOx, CO, and PM from 1990 to 2030 are shown in Figure 1-6 and operational levels at the Airport are also shown for comparative purposes. The findings for the 2030 air quality emissions inventory include:

- Since the current version of the FAA's Emissions and Dispersion Modeling System (EDMS) used for this *2011 ESPR* air quality emissions inventory does not reflect the anticipated significant design and operational improvements in aircraft engine technologies, alternative fuels, and aircraft operational measures, the estimated emission totals for 2030 are expected to be measurably less for all pollutants than the values predicted for 2030. Technology changes are likely to lead to lower fuel use, improved combustion efficiencies and lower emissions.
- Total emissions of NO_x in 2030 are predicted to be 11 percent lower than in 2000 but 24 percent higher than in 2011. This increase is almost entirely a result of the changing aircraft fleet (i.e., greater use of quieter Stage 3, higher NO_x-emitting aircraft) and the forecasted increase in operations at the Airport. However, compared to the AQI, NO_x emissions in 2030 are still shown to be 13 percent lower than 1999 levels– the benchmark for these emissions. The number of aircraft operations in 1999 was 494,816, about 4 percent higher than is predicted in 2030.
- Total emissions of VOCs in 2030 are predicted to be 36 percent lower than in 2000; however it is 2 percent higher compared to 2011. This small increase is mostly attributable to the forecasted increase in aircraft operations and anticipated increase in the number of vehicle trips of passengers, employees and other airport users.
- Total emissions of CO in 2030 are predicted to be 52 percent lower than in 2000 and 11 percent lower compared to 2011. This overall reduction is due to anticipated decreased aircraft taxi times and likely tighter emission controls for motor vehicles and off road-vehicles such as ground service equipment (GSE).
- Total emissions of $PM_{10}/PM_{2.5}$ in 2030 are predicted to be 22 percent lower than 2005 levels (2005 is the first year that $PM_{10}/PM_{2.5}$ emissions were reported), and 3 percent lower than 2011. This decrease since 2011 is mostly due to the lower emissions from GSE over this timeframe.
- Total emissions of GHG in 2030 are predicted to be 11 percent higher than 2011 levels due, in part, to the predicted 29 percent increase in aircraft operations associated with a 38 percent forecast increase in passenger traffic, and an anticipated 3 percent increase in terminal space area and utilization. The GHG calculation includes consideration of greater efficiency in aircraft movements and improvements in combustion efficiency of motor vehicles and GSE.

Figure 1-6 Long-Range Emissions Trends of VOCs, NO_X, CO, and PM at Logan Airport, 1990-2030[1]



Note: The dashed lines represent projected values.
1 PM emissions were not estimated until 2005.

Water Quality/Environmental Compliance and Management

- In 2011, there were 12 oil and hazardous material spills that required reporting to MassDEP, five of which involved a storm drainage system.[17] Further details on spills can be found in the *Fuel Use and Spills* section of *Chapter 8, Water Quality/Environmental Compliance.*
- One outfall sample out of a total of 19 samples at the Maverick Street Outfall and one outfall sample out of a total of 23 samples at the North Outfall exceeded the regulatory limits of the National Pollutant Discharge Eliminations System (NPDES) Permit for the North, West, and Maverick Street Outfalls. These exceedances were reported in April and November 2011, respectively, as required.

17 State environmental regulations require that oil spills of 10 gallons or more in volume be reported to MassDEP.

Sustainability at Logan Airport

Massport is committed to a robust sustainability program. Sustainability is often defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[18] All aspects of Massport's sustainability program are based upon this foundational definition of sustainable development and the "triple bottom line" approach to applied sustainability. The internationally recognized triple bottom line approach measures success not only by financial performance (the traditional bottom line), but by balanced achievements in environmental stewardship, economic growth, and social responsibility. The triple bottom line is achieved when an integrated solution is found that simultaneously achieves excellence in these components, as opposed to finding tradeoffs among these areas. Massport has a commitment to implementing environmentally sustainable practices authority- and airport-wide, and continues to make progress on a range of initiatives. Massport has a dedicated Sustainability Program Manager with responsibility to coordinate and fulfill this commitment across all lines of business.

The following sections describe how sustainability is incorporated into Massport's activities: goals and commitments; planning design and construction; operations and maintenance. Many of the long-term and multifaceted sustainability initiatives undertaken by Massport are described in individual chapters of this *2011 ESPR* where appropriate, and are listed in Table 1-8.

Sustainability Goals

Logan Airport is a complex of interconnected buildings, transportation facilities, utility infrastructure, natural environments, and management systems. The long-range planning, ongoing development, and day-to-day operations present opportunities to adopt sustainable practices that mirror Massport's long-standing environmental goals and demonstrate its leadership within New England and the aviation industry. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles.[19]

Massport Goals

In October 2004, Massport prepared the *Massachusetts Port Authority Sustainability Plan* which presents Massport's long-term and short-term sustainability goals (Table 1-4). It also identifies the actions necessary to achieve the goals, the staff members responsible for each sustainability goal, and the timeline for achieving the goals. The short-term goals set out in the Sustainability Plan are described below. Massport participated in the 2010 Environmental Benchmarking Survey sponsored by Airports Council International-North America (ACI-NA) to assess solar power, purchase of renewable energy, availability of low emission ground transportation, recycling and environmentally preferred purchasing.

With funding provided by a grant from the FAA, Massport will be embarking on the development of the Logan Airport Sustainability Management Plan in 2013. While Massport has many sustainability initiatives across the Airport, this planning effort will provide the necessary framework for Massport to coordinate all the separate initiatives under one comprehensive program. The status of this planning effort will be reported on in the *2012/2013 EDR.*

18 Brundtland Report, United Nations. "Report of the World Commission on Environment and Development." General Assembly Resolution 42/187, December 11. 1987.

19 The Environmental Management Policy can be viewed on Massport's website at: www.massport.com/environment/Pages/EnvironmentalManagementPolicy.aspx

Table 1-4 Sustainability Goals

Massport Sustainability Goals

- Develop a policy that states that new development projects obtain certification under the U.S. Green Building Council Leadership in Energy and Environmental Design® (LEED) Green Building Rating System™ and include LEED accredited professionals on the design team. LEED is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings.
- Establish and implement an Alternative Fuel Vehicle Policy (AFV) Policy that requires key personnel to review and consider AFVs when there is a request for a new or replacement vehicle and to select AFVs unless there is a compelling reason not to.
- Increase construction waste recycling and reuse.
- Implement a process to consider environmental impacts when making purchases.

Logan Airport Specific Sustainability Goals

- Establish a recycling program in Airport terminals.
- Retrofit or purchase heavy-duty equipment with diesel oxidation catalysts or particulate filters.

State Goals – Leading by Example

The Massachusetts' Governor's *Leading by Example – Clean Energy and Efficient Building Program* (known as the Leading by Example program) was established in 2007 under Executive Order 484.[20] The program's goals cover many specific measures covering a variety of topics, but there are three key areas which guide Massport's sustainability programs: energy intensity, percentage of renewable energy, and GHG reductions. Part of the Leading by Example Executive Order calls for state agencies to procure 15 percent of their electricity from renewable resources by 2012. The Leading by Example program has influenced Massport's own operations including its offices, heating plants, and garages leading to Massport receiving the Leading by Example award in 2008. As part of the Leading by Example Executive Order, all new construction and major renovations over 20,000 square feet by Commonwealth agencies must meet the Massachusetts LEED Plus green building standard established by the Massachusetts Sustainable Design Roundtable. The Massachusetts LEED Plus standard includes:

- Certification by the U.S. Green Building Council LEED program for all new construction and major renovation projects over 20,000 square feet;
- Energy Performance 20 percent better than the Massachusetts Energy Code;
- Independent third party commissioning;
- Reduction of outdoor water consumption by 50 percent and indoor water consumption by 20 percent relative to standard baseline projections; and
- Conformance with at least 1 of 4 identified smart growth criteria.

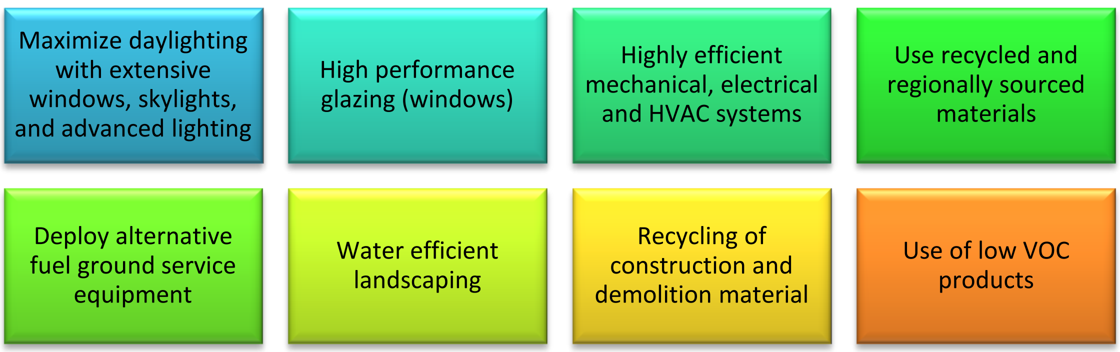
20 Deval Patrick, Executive Order 484: April 18, 2007.

Sustainability in Planning, Design and Construction

The following section outlines Massport sustainability achievements in the planning, design and construction of projects.

LEED Green Buildings
The U.S. Green Building Council's (USGBC) LEED Green Buildings rating system is the most widely recognized third-party green building certification system in North America. Massport is striving to achieve LEED certification for new and substantial rehabilitation of building projects over 20,000 square feet. For smaller building projects and non-building projects, Massport uses Sustainable Design Standards and Guidelines (SDGS) described in the next section. LEED-certified building elements are featured in Figure 1-7.

Figure 1-7 Common Elements of LEED-Certified Buildings at Logan Airport



Sustainable Design Standards and Guidelines (SDSG)
In 2009, Massport developed the SDSG for use by architects, engineers, and planners working on capital improvement projects at Massport facilities. The SDGS, revised and reissued in March 2011, provides a green building framework for design and construction both new construction and rehabilitation projects for both building and non-building projects, such as pavement projects.

The SDSG applies to a wide range of project-specific criteria, such as site design, project materials, energy management and efficiency, air emissions, water management quality and efficiency, indoor air quality, and occupant comfort. The new standards have been used to guide over $200 million in capital projects Massport-wide between fiscal years 2010 to 2013, including over $30 million for maritime projects.

International Standards Organization (ISO) 14001 standard
The ISO 14001 standard for environmental management systems (EMS) is used to minimize harmful effects on the environment caused by an organization's processes and activities. The goal of Massport's EMS is to achieve continual improvement of an organization's environmental performance. An EMS is different from LEED or the SDSG because its focus is on organizational operations and processes within a building as opposed to the design and materials used to construct buildings. Massport recently expanded its Logan Airport EMS to cover a broader range of activities and buildings. ISO 14001 certification for Logan Airport Facilities II (vehicle maintenance, landscaping, and snow removal) was completed in December 2006 and recertified in December 2009. ISO Certification for Facilities I (Central Heating and Cooling Plant) and Facilities III (Electrical and Structural) was completed in 2011.

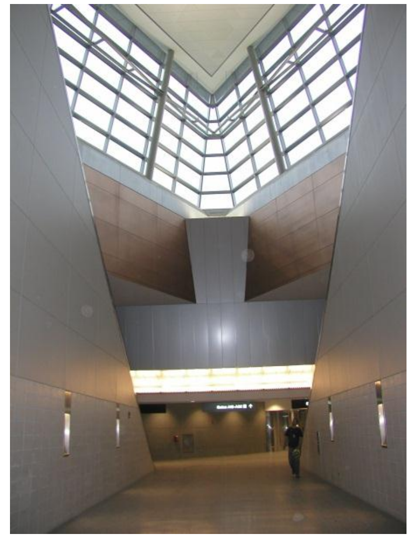
Certified Green Buildings at Logan Airport

Table 1-5 lists the sustainability features for the green buildings at Logan Airport that have been constructed or are under construction.

Table 1-5 Green Buildings at Logan Airport

Terminal A (LEED Certified) ■ Priority curb locations for high occupancy vehicles (HOV) and bicycles ■ Retrofitting with solar panels on the Terminal A roof ■ Stormwater filtration ■ Reflective roof ■ Water use reduction features ■ Natural daylighting paired with advanced lighting technologies for energy efficiency ■ Use of recycled and regionally sourced materials ■ Measures to enhance indoor air quality	Constructed 2005/2006
Signature Flight Support General Aviation Facility (LEED Certified) ■ Mechanisms to reduce water use ■ Natural day lighting paired with advanced lighting technologies for energy efficiency ■ Window glazing and sunshades to maximize daylight and minimize heat build-up ■ Recycled and regionally sourced materials ■ Measures to enhance indoor air quality	Constructed 2007/2008
Green Bus Depot (LEED Silver Eligible) ■ Sustainably grown, harvested, produced and transported building materials ■ Rooftop solar panels ■ Water and energy saving features ■ Vehicle miles traveled (VMT) reduction ■ New shuttle fleet including 50 clean diesel/electric hybrid buses and CNG buses	Completed 2012
Consolidated Rental Car Facility (Targeting LEED Silver) ■ Green building materials ■ Alternative energy sources (such as solar and wind) ■ Bike and pedestrian access and connections ■ Natural day lighting paired with advanced lighting technologies for energy efficiency ■ Use of recycled and regionally sourced materials ■ Enhanced indoor air quality ■ Plug-in stations for electric vehicles and other alternative fuel sources such as E-85 (ethanol) ■ Rental car fleets which include hybrid/alternative fuel/low emitting vehicles ■ Pedestrian connections ■ Bicycle facilities and employee showers/changing ■ Water reclamation for vehicle wash water, and use of stormwater for non-potable uses such as vehicle washing and landscaping irrigation ■ VMT reduction	Anticipated by 2013/2014
Facilities II (ISO 14001 certification) ■ Vehicle maintenance, landscaping, and snow removal	Completed 2006; Recertification 2009
Facilities I and III (ISO 14001 certification) ■ Central Heating and Cooling Plant ■ Electrical and Structural	Completed 2011

In 2006, the U.S. Green Building Council awarded LEED Certification to the new Terminal A, becoming the first LEED certified airport terminal in the world. The Signature Flight Support GA Facility in the NCA, which opened in June 2007, was the first LEED certified GA facility in the U.S. Experience gained at Logan Airport is serving as a model for new Signature Flight Support GA facilities around the U.S., including at Chicago O'Hare International Airport. Terminal A is currently being retrofitted with new solar panels.



Use of natural day lighting in Terminal A. Source: Massport.

The new ConRAC in the SWSA began construction in 2010 and will be completed in 2014. It will meet the Commonwealth of Massachusetts LEED Plus requirements and strive for LEED Silver level certification or better. At least 2.5 percent of the proposed program's overall electricity needs will be met with solar or wind power, or another form of renewable energy.

The Green Bus Depot in the NSA, recently completed in 2012 and currently operating, will also strive for LEED Silver Certification. The Green Bus Depot shifts bus maintenance operations on-Airport from an off-Airport location. This reduces bus trips and unnecessary emissions on congested neighborhood roadways. Reduced VMT for the bus fleet will have air quality benefits. Further details are available in *Chapter 3, Airport Planning*.

Sustainability in Operations and Maintenance

Massport has several programs in place that contribute to the environmentally sustainable operation and maintenance of Logan Airport and its facilities, which is further described in this section.

Energy

Massport continues to make strides in reducing energy use at the Airport. In 2010, the Massport Board approved a comprehensive Energy Master Plan for all Massport facilities. Further, the Board allocated funding for a capital project to implement energy efficiency improvements targeted at achieving energy and renewable energy targets as defined by the Governor's Executive Order 484 - *Leading by Example*. As part of the implementation of the Energy Master Plan, Massport is striving to achieve three Leading by Example Clean Building Energy Targets: a 25 percent reduction in GHG emissions; a 20 percent reduction in overall energy consumption; and a 15 percent of energy consumption from renewable sources, all of which are to be achieved by the end of fiscal year 2012.

Massport has been actively incorporating renewable and alternative energy features on key building projects. During fiscal year 2011 alone, 244,000 kilo-watt hours (kWh) of renewable electricity (close to 2 percent of Massport's total electricity consumption, excluding airfield and tenant electricity consumption) were generated at Logan Airport by solar panels and wind turbines. This is expected to increase as several new solar installations come online in the next several years. Table 1-6 provides a list of all current and planned renewable energy facilities.

Logan Office Center

As a demonstration project, Massport installed twenty 10-foot-tall wind turbines on the roof of Logan Office Center in March 2008. The wind turbines were designed to generate approximately 100,000 kWh annually, or about 2 percent of the building's monthly energy use. This represents an annual savings of $13,000 a year in energy costs, and a payback period of ten years, and about one ton of avoided carbon emissions annually. Logan Airport was the first commercial airport to generate clean energy using wind.

Terminal B Garage Renovations

In 2009, Massport began a four-year rehabilitation of the Terminal B parking garage that includes structural repairs and the installation of solar panels on the top parking deck. In addition, the garage, roadways and walkways were retrofitted with energy-efficient LED lighting to further maximize efficiency. The project was completed in March 2012. During 2010, the energy-related upgrades were completed. The motion-detecting LED fixtures use approximately 50 percent less electricity than the previous lighting fixtures.

Table 1-6 Terminal B Solar Photovoltaic (PV) Panel Lifetime Data

Electricity Produced	571,473	kWh
CO_2 avoided	986,363	lbs
NO_x avoided	1,434	lbs
SO_2 avoided	4,320	lbs

Note: Recorded as of September, 2012.
Real-time power generation reporting for the solar panels as well as historical numbers and bar charts are available at: http://siteapp.fatspaniel.net/siteapp/detailView.jsf?eid=386776).

Each of the 32 solar panels is a single structure design with a stem and steel frame that uses solar panels as a roof over parked cars. These are mounted on an air ventilation unit on the roof of the garage and do not affect parking operations or the number or spaces available to travelers. As shown in Table 1-6, data recorded to date show that the Terminal B solar installation has produced about 570,000 kWh of electricity (238,000 kWh in fiscal year 2011 alone). In fiscal year 2011, the solar panel installation generated 22 percent of total annual electricity consumption for the garage.

Solar Panels on the roof of Terminal B Garage. Source: Massport.

While not directly related to energy use, Massport also set two rain collection water storage tanks as part of the Terminal B garage improvements. Massport is currently exploring options to re-use rainwater collected in the tanks to supplement such needs as landscape watering and street sweeping.

Economy Parking Garage

Massport installed 18 solar trees at the newly constructed Economy Parking Garage in 2011. These solar trees will provide 2 to 6 percent of the energy needs for the new facility, which also uses energy efficient LED lighting throughout.

Terminal A

Massport coordinated with a third-party developer to design and install solar panels on the roofs of both the Terminal A and the Terminal A Satellite Buildings. After receiving a grant for a portion of the installation costs, the remaining costs will be recovered by the developer through a long term power purchase agreement (PPA) with Massport for the purchase of electricity by the solar generation stations. Total annual power production will average approximately 453,000 kWh from both sites over the term of the PPA. Construction on both Logan Terminals was completed in December 2011.

Hanscom Field
Massport installed 222 solar panels on the Civil Air Terminal Building to produce clean renewable energy for Hanscom Field in 2011. The solar panels are located along the south-facing side of the building and include a series of wall-mounted panels along the building's façade. The 51.2 kW-rated photovoltaic panel system is expected to produce 57,233 kWh of electricity annually, or 10 percent of the building's total annual consumption.

Table 1-7 shows the rated capacity of Logan Airport actual and planned renewable energy installations.

Table 1-7 Rated Capacity of Renewable Energy Installations at Massport-owned Facilities

Solar PV	ConRAC	140 kW	Planned
	Green Bus Depot	50 kW	Planned
	Economy Parking Garage	81 kW	Completed
	Hanscom Field	50 kW	Completed
	Terminal A	300 kW	Completed
	Terminal A Satellite	93 kW	Completed
	Terminal B Garage	200 kW	Completed
Wind	Logan Office Center	20 kW	Completed

In addition to its renewable energy projects, Massport has also been exploring the purchase of renewable energy certificates (RECs) for some of its electricity needs to supplement its on-airport renewable generation.

Massport also operates a central heating and cooling system on Logan Airport, which is an efficient method of providing heating and cooling to multiple buildings in a large campus setting. The function of the central heating plant (CHP) is to provide both heating and cooling to the terminals and high temperature hot water to West Garage, Logan Office Center, Facilities I, and Hangars 8, 9, and 16. The CHP is also a centralized location for emergency power for Terminal E and Pier A of Terminal C. As part of Massport's Energy Master Plan, Massport is investigating ways to improve further the efficiency of the CHP therefore realizing even more benefits from this efficient energy management system.

Clean Technologies
Massport utilizes advanced technology whenever possible to encourage energy efficiency and reduce GHG emissions:

- Massport has equipped all jet bridges with 400 Hz power and/or pre-conditioned air (PCA), which reduces use of on-board gas powered auxiliary power units (APUs) and their associated air emissions. With the completion of the Terminal B improvements in 2014, all Logan Airport gates will have both 400 Hz power and PCA.
- Logan Airport was the first airport in the U.S. to use warm mix asphalt for its airfield pavement. The outer edges of Runway 4R-22L were repaved using this material in 2008; Runway 9-27 and the Centerfield Taxiway were both paved using this material in 2009. Warm mix is heated to a lower temperature than hot mix asphalt, which saves energy, resulting in 20 percent lower GHG emissions than hot mix asphalt. On Runway 9-27, this equated to a reduction of nearly 4,000 tons of CO_2, a savings of about 400,000 gallons of diesel fuel, and an energy savings of about 53 billion British Thermal Units (BTUs). Warm mix manufacturing reduces dust and NOx emissions on site and at the manufacturing plant, and combined with its lower temperature, results in a better working environment for installation crews. Warm mix asphalt contains about 20 percent recycled material, and can be applied in a thicker layer, requiring fewer passes with construction vehicles and fewer emissions of associated pollutants.

- Massport is testing an innovative automated system to retrieve hazardous foreign object debris. While this is primarily a safety measure, it does save time, money, some daily driving on the part of Airport Operations, and provides environmental benefits by reducing emissions of air pollutants associated with vehicle trips to inspect the runways.
- Massport replaced larger, inefficient, and difficult-to-maintain lamps on one taxiway with smaller, more efficient and easier-to maintain LED lighting starting in 2005. The project has been so successful that it has been expanded to other taxiways on the airfield.

Alternative Fuel Vehicles (AFVs)
As part of its environmental management policy, Massport purchases new alternative fuel or hybrid power vehicles to replace conventional vehicles when feasible. Massport encourages programs and projects that promote the use of electric and AFVs by planning for and constructing the necessary infrastructure to support current and future generations of electric and AFVs. The following projects and programs support AFVs:

- Delta Airlines recently converted much of its fleet of GSE to an all electric fleet at Logan Airport. Massport collaborated with Delta Airlines on this project by financing a low-interest loan to Delta to purchase the electric fleet and associated infrastructure. Conversion of the GSE fleet to all electric reduces greenhouse gas emissions from ground equipment at the Airport.
- Massport installed 13 new electric vehicle charging stations to accommodate a total of 26 vehicles in the Central and Terminal B parking garages**.** Passengers can park their electric vehicles at these stations to plug in, leave for their trips, and come back to a fully re-charged vehicle. The ConRAC, described above, will also include the infrastructure necessary to accommodate plug-in stations for electric rental vehicles. When constructed, the new ConRAC will include charging stations which conform to the new North American fast-charging standard SAE J1772-2009 electrical connector. All new mass-produced electric vehicles available starting in 2010 use this connection configuration.
- In 2010, Massport was awarded a grant from the FAA's Voluntary Airport Low Emissions Program (VALE) program to fund 75 percent of the incremental cost for the purchase of a new hybrid bus fleet for the ConRAC facility. Massport spent $35 million for a fleet of 50 alternative fuel buses in 2012, including 32 60-foot long articulated buses with diesel-electric hybrid engines and 18 42-foot long CNG buses. When the ConRAC is completed and the new ConRAC unified bus system is operational, these cleaner more fuel efficient buses will replace the less fuel efficent 94 rental car buses currently being used and Massport's older CNG buses. Massport expects this new unified bus system to reduce CO_2 emissions by 1,840 tons, NO_x by 50 tons, and VOCs by 25 tons during the new buses' estimated 12 years lifecycle.
- The 2008 renovations to the existing public gas station in the NCA included installing an E85 fuel dispensing tank. E85 is a first-generation biofuel which helps reduce dependence on foreign sources of oil.
- One of the largest public CNG stations in New England is at Logan Airport. CNG is a cleaner fuel, producing significantly lower amounts of harmful emissions than other vehicle fuels.[21]
- Massport's "CleanAir Cab" incentive program for AFVs or hybrid taxis, started in 2007 in cooperation with the City of Boston, continues to be successful. These taxis are given head of the line privileges in the taxi queue and passengers can request an AFV or hybrid taxi from the taxi queue. As a result of a large increase in the number of hybrid taxis in Boston's taxi fleet since 2007, two hybrid taxis are now given priority as part of each 10-car dispatch group from the taxi queue. Massport provides a 50 percent reduction in ground access fees for alternative fueled limousines and hotel shuttles. Massport provides reserved parking spaces for hybrid and AFVs in Logan Airport's garages.

21 For more information on the cleaner burning performance of CNG vehicles visit the EPA's website: http://www.afdc.energy.gov/afdc/vehicles/natural_gas_emissions.html

- Massport has supported and sponsored the Boston GreenFest since 2009 and AltWheels Fleet Day since 2003. These are annual forums to promote alternative fuels and sustainable transportation modes. Massport has been a financial sponsor of these events. Massport AFVs are exhibited on Fleet Day alongside an exhibit booth, and Massport's CNG buses transport attendees between event sites.

Waste, Recycling and Materials
Massport uses innovative practices to reduce material consumption and maximize recycling rates. All Airport vendors and airlines have access to recycling facilities, and contractors working on Airport construction projects are required to meet specific recycling standards. Highlights from Massport's waste and recycling program include:

- Massport implemented a single stream recycling program at Logan Airport consisting of the interior public areas of all of the terminals, both post-security and pre-security, as well as Logan Airport administrative offices. This includes collection of mixed paper (newspaper, cardboard and magazines), plastics, aluminum, and glass.
- For capital construction projects, Massport requires construction contractors to recycle the construction and demolition waste (C&D) generated by their projects. In May 2011, Massport began tracking the amount of materials recycled during capital construction projects. Between May and December 2011, Massport recycled almost all C&D materials from capital construction projects, 51,368 tons or 98 percent of C&D materials.
- Some concessionaires have their own corporate waste reduction and recycling programs supported by their own brand, and use biodegradable plastic bags, utensils, and takeout containers. Massport requires recycling through tenant leases, and all concessionaires have access to recycling.

Terminal Recycling Container. Source: Massport.

- Massport's environmentally preferred procurement policy requires purchase of environmentally preferrable versions of most products purchased by Massport. The policy covers items from recycled paper for Massport offices, to environmentally friendly cleaning supplies.
- In April 2011, Massport hosted a hazardous waste collection event at Logan Airport. Massport employees, along with employees of airlines and airport tenants, were encouraged to bring hazardous materials from their homes and workstations to Logan Airport for safe disposal and recycling. The event resulted in 10.3 tons of hazardous materials such as batteries, paints and solvents, pesticides, electronic waste, aerosol cans, and propane tanks being collected for safe disposal. Massport also hosted hazardous waste collection events at other Massport locations, such as Hanscom Field, in 2011.
- Massport SDSGs also aims to support the New England economy and support reuse of local materials and reduce transportation costs and emissions by providing a credit for Regional Materials. This credit requires that a project create a local purchasing goal that specifies the amount of materials to be extracted, harvested, recovered and /or manufactured within New England for the purposes of the project.
- Since 2005, Massport has been a member of the EPA's WasteWise Program, a national voluntary solid waste reduction program. Massport gains access to the best practices of over 1,000 members and strives to establish new waste prevention activities, expand or improve current recycling efforts, and purchase additional products with recycled content.

- Logan Airport supports a recycling program for waste vegetable oil produced by Airport restaurants and concessionaires through a third party. To better monitor this effort, Massport began tracking waste vegetable oil disposal and recycling in 2011.
- Massport provides all airlines with the facilities necessary to support in-flight recycling, but participation is determined by each individual airline, sometimes on a flight-by-flight basis. Delta Air Lines now recycles paper, plastic, and aluminum from all of its flights that land at Logan Airport.[22]

Sustainable Landscaping Programs
Logan Airport's landscape encompasses both marine and urban environments. Massport's landscaping program not only results in beautiful, naturalistic landscaping at the Airport, but includes the careful selection of native, drought tolerant plants and shrubs. Massport's landscaping program includes:

- Designs that are "naturalistic" rather than formal, as these typically require minimal care and maintenance, provide seasonal interest, and self-generate (an example of this is Sensitive and Royal Ferns).
- Selection of hardy plant materials, especially indigenous where appropriate, that thrive in specific airport landscapes, and are resistant to pests.
- Minimal use of lawn and extensive use of hardy groundcovers, especially those that demonstrate seasonal interest.
- Use of perennials instead of annuals in the Airport landscape.
- Use of mulch for shrub and perennial beds to retain moisture and reduce watering

Drought-resistant perennials at Logan Airport. Source: Massport.

In addition to sustainable landscaping design, Massport has been involved with cooperative efforts to expand the City of Boston's tree cover. Massport participates in the Grow Boston Greener Program, a City of Boston and Massachusetts Department of Conservation and Recreation sponsored initiative to increase Boston's tree cover from 29 percent to 35 percent by 2020. Boston Natural Areas Network (BNAN) was contracted to administer the Grow Boston Greener Program and the Boston Urban Forest Council (BUFC) is an advisory and advocacy group for the tree-tracking effort. This initiative includes the planting of at least 100,000 trees as well the creation of a record-keeping system for trees planted since 2008. In support of this program, Massport tracks and reports on an annual basis, the number, types, and locations of trees that Massport is planting on Logan Airport and Port properties within the City of Boston.

Internal Education and Training
Massport has a program that educates Massport staff on everyday ways to save energy and reduce waste while at work. Informational signs and flyers for staff contain details on the types of materials that can be recycled at work and strategies for saving energy on a daily basis by, for example, turning off lights when leaving a conference room or office, and turning computers off at night.

22 Due to U.S. Department of Agriculture (USDA) and U.S. Customs and Border Protection (USCBP) regulations, waste from international flights is considered regulated waste and must be separated and incinerated or sterilized at a special facility.

Additional Sustainability Programs and Initiatives

A selection of Massport's sustainability programs and initiatives, provided in Table 1-8, are further described in individual chapters of this *2011 ESPR*. They are highlighted in each chapter with a sustainability leaf

Table 1-8 Additional Sustainability Projects and Initiatives Documented in the ESPR

Sustainability Program or Initiative	Description	Reference in *2011 ESPR*
GreenDOT and Massachusetts Healthy Transportation Compact	Statewide transportation initiatives that balance the needs of all transportation users, improve public health, and reduce the environmental impact of transportation.	Chapter 4, Regional Transportation
Logan Transportation Management Association (Logan TMA)	The Logan TMA helps to reduce the number of Airport employees commuting by private automobile, to enhance commuter options, and to reduce traffic and parking demands at Logan Airport.	Chapter 5, Ground Access to and from Logan Airport
Pedestrian Facilities and Bicycle Parking	Sidewalks are available along most Airport roadways, overhead pedestrian bridges provide pedestrian connections to all terminals. Bicycle parking is also available at terminals.	Chapter 5, Ground Access to and from Logan Airport
Preferred Parking for Alternative Fuel Vehicles	Massport has preferred parking areas in garages, close to terminal entry points for alternative fuel or hybrid vehicles.	Chapter 5, Ground Access to and from Logan Airport
Logan Airport Silver Line and Blue Line Rapid Transit Service	Massport supports MBTA rapid transit service which serves all terminals at Logan Airport from South Station and Airport Station.	Chapter 5, Ground Access to and from Logan Airport
High occupancy vehicle (HOV) goals	The goal of Massport is to attain a 35.2 percent HOV ground access mode share at the 37.5 million air passenger annual level.	Chapter 5, Ground Access to and from Logan Airport
Cell Phone Waiting Lot	The recently expanded Cell Phone Waiting Lot has helped to reduce vehicle emissions by minimizing idling and vehicle miles traveled (VMT).	Chapter 5, Ground Access to and from Logan Airport
Logan Air Quality Initiative (AQI)	The AQI is a 15-year voluntary program with the goal of maintaining NOx emissions at, or below, 1999 levels.	Chapter 7, Air Quality/Emissions Reduction
Massport Alternative Fuel Vehicle Purchasing Policy	This is a policy to replace conventionally-fueled fleet with alternatively fueled or powered vehicles, when feasible.	Chapter 7, Air Quality/Emissions Reduction
Participation in statewide climate change related groups	Massport participates in working groups focused on achieving goals in the Global Warming Solutions Act, as part of the Commonwealth's Climate Change Adaptation Advisory Committee	Chapter 7, Air Quality/Emissions Reduction
Air Quality Studies	Massport participates in or has commissioned air quality related studies such as the Massachusetts Department of Public Health study, the Massport Air Quality Monitoring Study, and MIT research on single engine taxiing.	Chapter 7, Air Quality/Emissions Reduction
Energy Planning	Massport's Energy Master Plan is being implemented in phases to reduce Logan Airport's overall energy consumption.	Chapter 7, Air Quality/Emissions Reduction

Sustainability Awards

Table 1-9 highlights some of the most recent environmental sustainability-related awards Massport has received. Massport has repeatedly been recognized as an environmental leader by national and international organizations in various industries.

Table 1-9 Selected Sustainability Awards

Year	Awarding Organization	Name of Award	Subject
2010	Construction Management Association of America (CMAA)	CMAA Infrastructure Award of the Year	This award was for the rehabilitation of Runway 9-27 with warm mix asphalt. Warm mix asphalt uses less energy to produce and results in fewer greenhouse gas emissions.
2009	American Association of Port Authorities	Comprehensive Environmental Management Award	This was awarded for Massport's Sustainable Design Standards and Guidelines
2008	American Institute of Aeronautics and Astronautics (AIAA), the American Association of Airport Executives (AAAE), and the Airports Consultants Council (ACC)	Jay Hollingsworth Speas Airport Award	The award recognizes the environmental benefits achieved by Terminal A at Boston Logan International Airport, the world's first LEED certified airport terminal.
2008	Commonwealth of Massachusetts	Leading by Example Awards	The Leading by Example Awards recognize outstanding efforts among Commonwealth agencies, public colleges and universities, and municipalities which have established and implemented policies and programs resulting in significant and demonstrable environmental benefits.
2008	Airports Council International –North America (ACI-NA)	Environmental Management Award	Logan Airport's Air Quality Program / Emissions Reduction Program
2007	Business travel website Aviation.com.	"Easiest Airport to Get To"	Logan Airport is among the closest airports in the country to the Central Business District of a major city with a five-minute drive or 15-minute rapid transit ride to downtown Boston, reducing emissions associated with accessing the airport, when compared to peer airports.

Organization of the *2011 ESPR*

The remainder of this *2011 ESPR* is organized as follows:

- ***Chapter 2, Activity Levels***, presents aviation activity statistics for Logan Airport in 2011 and compares activity levels to the prior year. The specific activity measures discussed include air passengers, aircraft operations, fleet mix, and cargo/mail volumes. This chapters also provides Massport's long-range 2030 aviation forecast for Logan Airport
- ***Chapter 3, Airport Planning***, provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2011. It also describes known future planning, construction, and permitting activities and initiatives.
- ***Chapter 4, Regional Transportation***, describes activity levels at New England's regional airports in 2011 and updates recent regional planning activities.
- ***Chapter 5, Ground Access to and from Logan Airport***, reports on transit ridership, roadways, traffic volumes, and parking for 2011. It also provides forecsts for traffic volumes, parking, and VMT for the year 2030.

- ***Chapter 6, Noise Abatement***, updates the status of the noise environment at Logan Airport in 2011, and describes Massport's efforts to reduce noise levels. It also provides noise contours population counts for 2030.
- ***Chapter 7, Air Quality/Emissions Reduction***, provides an overview of Airport-related air quality issues in 2011 and efforts to reduce emissions. It also predicts emission levels for 2030.
- ***Chapter 8, Water Quality/Environmental Compliance and Management***, describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan (MCP), and tank management.
- ***Chapter 9, Project Mitigation Tracking***, reports on Massport's progress in meeting its MEPA Section 61[23] mitigation commitments for specific Airport projects.

Supporting appendices include:

- **MEPA Appendices**: The Secretary of EEA's Certificate on the *2010 EDR*, comment letters received on the *2010 EDR* and responses to those comments, Secretary of EOEEA's Certificates on the annual reports issued for reporting years 2004 through 2009, a list of reviewers to whom the *2011 ESPR* was distributed, and a proposed scope for the *2012/2013 EDR*.
- **Technical Appendices**: These include detailed analytical data and methodological documentation for the various environmental analyses presented in and conducted for this *2011 ESPR*.

23 Massachusetts General Law, Chapter 30, Section 61 (M.G.L. c. 30, § 61).

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Activity Levels

Introduction

This chapter reports on annual air traffic activity at Logan Airport in 2011, including air passengers, aircraft operations, aircraft fleet mix, and cargo volumes. Air traffic activity levels at Logan Airport form the basis for the evaluation of vehicle miles traveled (VMT), noise, and air quality impacts associated with the Airport. The 2011 activity levels at the Airport are compared to 2010 levels, and historical passenger and operation trends at Logan Airport since 2000 are reviewed. This *2011 Environmental Status and Planning Report (ESPR)* also provides an opportunity to revisit previous forecasts completed in 2003 and documented in the *2004 ESPR*, and revise them based on current and predicted conditions. This chapter includes a discussion of national aviation trends since 2000 and the updated 2030 long-range forecast of aviation activity levels at Logan Airport. The updated planning year, 2030, includes consideration of changes in aircraft fleet mix, anticipated airline industry trends, and likely destinations to be served by Logan Airport air carriers. Similar to other ESPRs, the document provides an overview of Massachusetts Port Authority's (Massport) updated forecasts for future passenger, aircraft and cargo activities. The future forecasts will again be revisited during the next ESPR cycle (approximately five years after this *2011 ESPR*), if necessary.

The chapter specifically describes 2011 activity levels, historical trends, and the 2030 forecast activity levels for:

- Air passengers and aircraft operations at Logan Airport
- Cargo and mail volumes at Logan Airport
- Airline service at Logan Airport

Key Findings

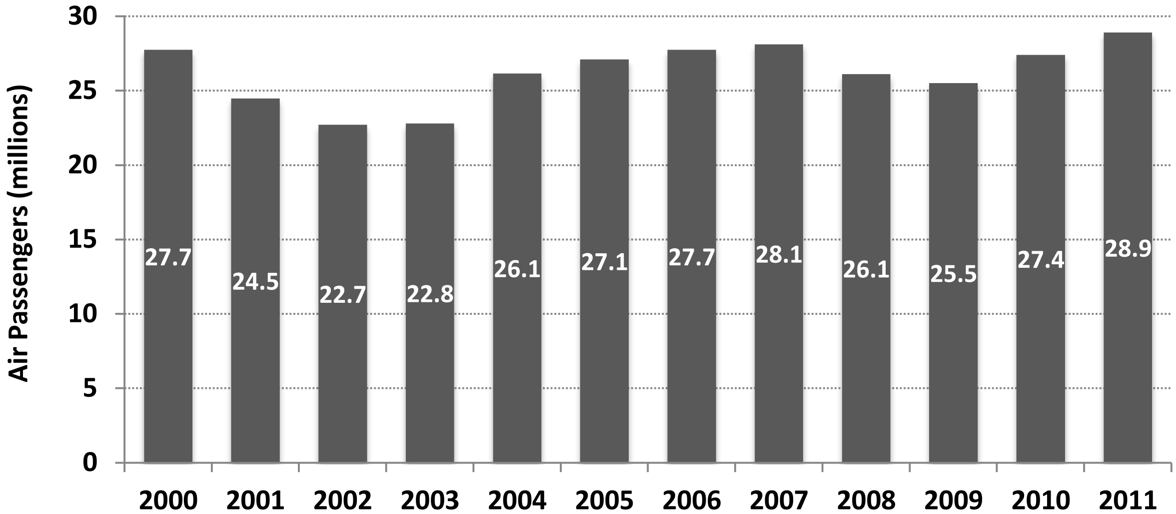
Logan Airport saw an overall increase in passengers and aircraft operations in 2011. The trend of increasing activity levels at the Airport marked a continued recovery from high fuel prices and the economic recession that depressed traffic levels across the U.S. in 2008 and 2009. Air traffic increases at Logan Airport have been driven primarily by the growth of low-cost carriers (LCCs), including JetBlue Airways and Southwest Airlines, over the past decade. JetBlue Airways in particular has continued to expand rapidly at the Airport in recent years, even as many legacy carriers reduced services and consolidated operations. In 2011, passenger levels at Logan Airport reached a new peak, exceeding the previous 2007 historic peak. Aircraft operations at the Airport have grown at a slower pace than passenger traffic, as legacy carriers have restricted growth in aircraft operations, leading to higher load factors, and a move towards larger, more fuel-efficient aircraft in the new high-cost fuel environment.

Notable changes in passenger, operations and cargo activity at Logan Airport in 2011 included the following:

- The total number of air passengers at Logan Airport increased by 5.4 percent to 28.9 million, compared to 27.4 million in 2010 (Figure 2-1). Previously, annual air passengers at the Airport increased by 7.5 percent between 2009 and 2010. Passenger levels in 2011 represent a new record, exceeding the 2007 peak of 28.1 million annual air passengers. In 2000, Logan Airport accommodated 27.7 million air passengers.
- The total number of aircraft operations[1] grew from approximately 352,640 in 2010 to 368,990 in 2011, an increase of 2.1 percent. Aircraft operations at Logan Airport in 2011 remained well below the 487,996 operations peak in 2000 and the historic peak achieved in 1998. Passenger aircraft operations, which accounted for 91 percent of total aircraft operations, increased by 0.8 percent compared to 2010 levels.
- General aviation[2] (GA) operations, which accounted for 8 percent of total operations, increased by 92.3 percent over 2010 levels. This marked a strong recovery in GA activity at Logan Airport as a result of improving economic conditions, following steep declines in GA operations from 2008 to 2009 due to the economic recession. The 28,230 GA operations in 2011 were still below the GA levels in 2000, which totaled 35,233 GA operations.
- There were 6,270 dedicated air cargo operations at Logan Airport in 2011, which represents a decline of 0.1 percent compared to the previous year. All-cargo operations have fallen by nearly 50 percent since 2000 when Logan Airport accommodated 12,282 air cargo operations.
- The number of air passengers per aircraft operation continued to increase, climbing from an average of 77.8 passengers per aircraft operation in 2010 to an average of 78.3 passengers per aircraft operation in 2011, reflecting even greater efficiency. This compares to 56.8 passengers per operation in 2000.
- JetBlue Airways continued to expand service rapidly at Logan Airport, increasing its total operations by 22.3 percent compared to 2010. In 2011, the number of JetBlue Airways' operations exceeded those of US Airways to become the largest carrier in terms of aircraft operations at Logan Airport. JetBlue Airways, already the largest carrier in terms of passengers, overtook both American Airlines and Delta Air Lines in 2010. JetBlue Airways accounted for 19.1 percent of aircraft operations and 22.8 percent of total passengers at Logan Airport in 2011.
- Legacy air carriers maintained tight capacity discipline, while LCCs increased operations. Legacy carriers continued to reduce domestic operations slightly in 2011, eliminating less profitable routes. In contrast, LCC operations have steadily increased. LCCs accounted for 32.5 percent of domestic operations at Logan Airport in 2011, compared to 28.6 percent in 2010, 9.0 percent in 2003 prior to JetBlue Airways' entry, and just 2.9 percent in 2000.
- Air cargo volumes, including shipments transported in the belly compartments of passenger aircraft, decreased from 572 million pounds in 2010 to 555 million pounds in 2011, a decline of 3.1 percent. As shown in Table 2-6, the largest volume decrease occurred in the freight segment. In comparison, Logan Airport's air cargo volume exceeded 1 billion pounds in 2000.

1 An aircraft operation is defined as one arrival or one departure.
2 General Aviation (GA) is defined as all aviation activity other than commercial airline and military operations.

Figure 2-1 Passenger Activity Levels at Logan Airport, 2000-2011



Source: Massport.

Periodically, Massport updates its long-range planning forecasts for the three Massport airports (Logan Airport, Worcester Regional Airport, and Hanscom Field) to reflect the current status of the airline industry and emerging trends that are expected to influence future aviation activities. In 2011, Massport updated the Logan Airport long-range forecast using 2010 as the base year and 2015, 2020, and 2030 as the forecast years. Three scenarios were also developed (Low, Moderate, and High). Massport views the Moderate forecast scenario as the most likely forecast of future activity levels at Logan Airport. Highlights for the long-range Moderate forecast for 2030 include:

- The total number of air passengers at Logan Airport is projected to increase by 1.7 percent annually and reach 39.8 million in 2030. Domestic passengers are forecast to be 32.1 million, an increase of 1.4 percent per year, while international passengers are forecast to be 7.6 million, an increase of 3.5 percent per year.
- GA passenger traffic is forecast to remain relatively stable over the forecast period at approximately 108,000 passengers.
- Aircraft operations are forecast to increase at a slightly slower rate than passenger traffic, growing by 1.3 percent per year. By 2030, Logan Airport is forecast to accommodate 474,734 annual aircraft operations. Passenger airlines are expected to account for nearly 93 percent of total aircraft operations at Logan Airport in 2030.
- In 2000, there were 487,996 operations with 27.7 million passengers as compared to projected operations of 474,734 and annual passengers of 39.8 million in 2030.
- The projected fleet mix for Logan Airport reflects a continuation of airline industry fleet trends that include movement into larger capacity jet aircraft, a reduction in small regional jet (RJ) aircraft and increases in larger RJs and turboprops, which have more favorable operating costs in a high fuel price environment. At Logan Airport, the passenger airline aircraft fleet mix is expected to shift towards larger capacity jet aircraft. As a result of the expected shifts in the fleet mix and slightly higher passenger load factors, the average number of passengers per passenger airline operation is predicted to rise from 78 in 2011 to 84 in 2030.

- The total volume of cargo at Logan Airport is forecast to increase by 2.6 percent per year from 529 million pounds in 2011 to 867 million pounds in 2030. While the cargo volume has declined overall since 2000, the decline was mainly the result of a modal shift as FedEx and United Parcel Service (UPS) began to rely more on trucking to move their less time-sensitive packages. More recently, the 2008/2009 Economic Recession and slow pace of recovery have depressed cargo activity at Logan Airport. The modal shift has largely occurred and is not expected to affect cargo in the future. Economic growth is expected to be the main driver of cargo demand over the long-range planning horizon.

Air Passenger Levels in 2011

The following section provides an overview of air passenger levels in 2011 for Logan Airport.

Logan Airport Passengers

Passenger traffic at Logan Airport totaled 28.9 million in 2011, compared to 27.4 million in 2010. This represents an increase of 1.5 million passengers or 5.4 percent between 2010 and 2011. Previously, passenger traffic had increased by 7.5 percent between 2009 and 2010. The passenger traffic level in 2011 represents a historic high for Logan Airport, exceeding the previous record of 28.1 million in 2007. Passenger growth at Logan Airport continues to outpace overall U.S. passenger growth. Total scheduled passenger traffic in the U.S. increased by only 1.7 percent in 2011.[3] Factors that contributed to the strong passenger growth at Logan Airport in 2011 included:

- The continued robust expansion of JetBlue Airways at Logan Airport, and
- A return to modest economic growth for the U.S. economy, resulting in a gradual recovery in air travel demand across the nation.

As shown in Table 2-1, domestic air passengers, which represent Logan Airport's largest market segment at 85.9 percent of total passengers, increased by 4.8 percent over 2010 levels. JetBlue Airways' continued expansion at Logan Airport was the main contributor to this growth. JetBlue Airways carried 6.2 million domestic passengers in 2011, an increase of 1.4 million passengers over 2010. Figure 2-2 shows the annual passengers for the five dominant airlines at Logan Airport and highlights the rapid expansion of JetBlue Airways since 2004. Overall, the tremendous LCC growth at the Airport over the past decade – with JetBlue Airways' entry in 2004 and Southwest Airlines' entry in 2009 in particular – has exceeded consolidation and contraction among legacy carriers.[4] Domestic passenger activity levels have recovered after the events of September 11, 2001, climbing to 23.8 million in 2007, and reaching a new peak of 24.8 million in 2011.

3 Bureau of Transportation Statistics, 2011.

4 Delta Air Lines and Northwest Airlines merged in 2009, and United Airlines and Continental Airlines merged in 2010. At Logan Airport, total passengers carried by the consolidated Delta Air Lines decreased 10.7 percent in 2010, followed by a modest increase of 3.6 percent in 2011. Total Logan Airport passengers carried by the consolidated United Airlines decreased by 0.3 percent in 2011.

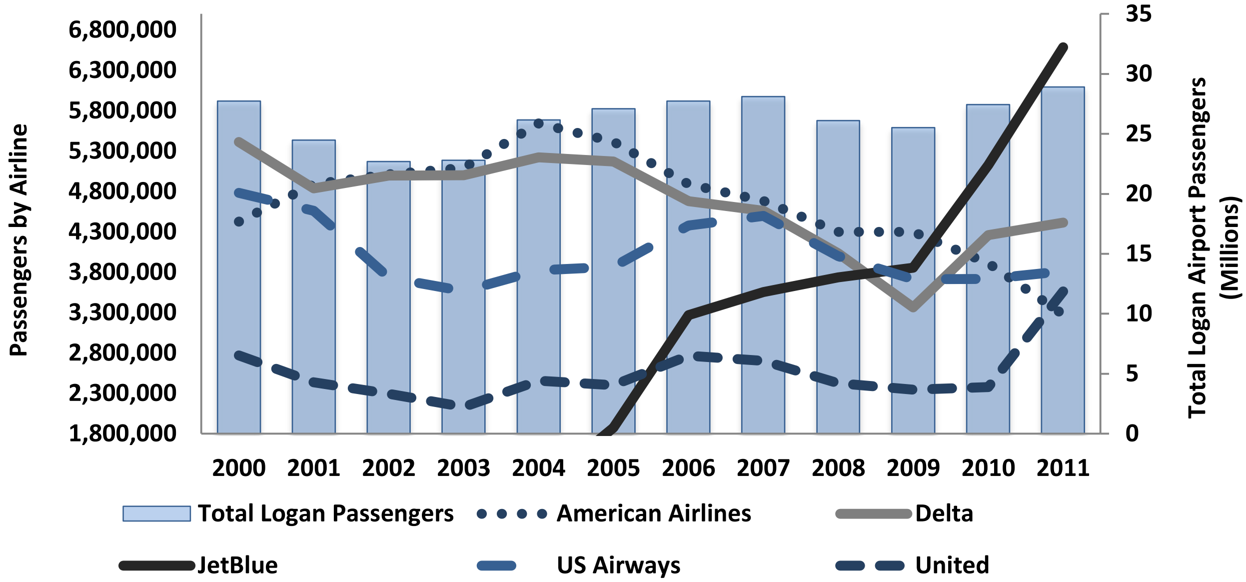
Table 2-1 Air Passengers by Market Segment, 2000-2011

	2000	2001	2002	2003	2004	2005	2006
Domestic	**23,100,645**	**20,070,039**	**18,725,422**	**18,890,079**	**21,830,294**	**22,728,788**	**23,556,382**
International	**4,513,192**	**4,301,250**	**3,882,257**	**3,815,987**	**4,201,638**	**4,237,105**	**4,049,595**
Europe/ Middle East	2,948,452	2,661,471	2,469,822	2,435,997	2,590,225	2,629,823	2,599,382
Canada	833,669	733,559	670,457	564,018	622,098	682,904	621,185
Bermuda/ Caribbean	693,620	905,962	728,992	786,574	911,757	845,863	784,477
Asia/Pacific	37,451	258	0	0	0	0	0
Central/South America	0	0	12,986	29,398	77,558	78,515	44,551
General Aviation	**112,996**	**103,641**	**88,462**	**85,103**	**110,584**	**122,012**	**119,466**
Total Passengers	**27,726,833**	**24,474,930**	**22,696,141**	**22,791,169**	**26,142,516**	**27,087,905**	**27,725,443**

	2007	2008	2009	2010	2011	Pct. Change (2010-2011)	Avg. Annual Growth (2000-2011)
Domestic	**23,837,727**	**22,032,246**	**21,767,086**	**23,688,471**	**24,831,068**	**4.8%**	**0.7%**
International	**4,153,442**	**3,977,297**	**3,696,336**	**3,681,739**	**3,962,454**	**7.6%**	**(1.2%)**
Europe/ Middle East	2,754,427	2,687,693	2,605,825	2,672,635	2,939,226	10.0%	(0.0%)
Canada	581,178	552,745	453,430	518,088	573,660	10.7%	(3.3%)
Bermuda/ Caribbean	807,094	731,946	636,719	486,911	447,650	(8.1%)	(3.9%)
Asia/Pacific	0	392	0	0	0	0.0	-
Central/South America	10,743	4,521	362	4,105	1,918	(53.3%)	-
General Aviation	**111,286**	**93,108**	**48,664**	**58,752**	**114,416**	**94.7%**	**0.1%**
Total Passengers	**28,102,455**	**26,102,651**	**25,512,086**	**27,428,962**	**28,907,938**	**5.4%**	**0.4%**

Source: Massport.
Notes: Subject to revised domestic and Caribbean passenger numbers from Massport.
Numbers in parenthesis () indicate negative number.

Figure 2-2 Annual Passengers at Logan Airport Among Top Five Airlines, 2000-2011

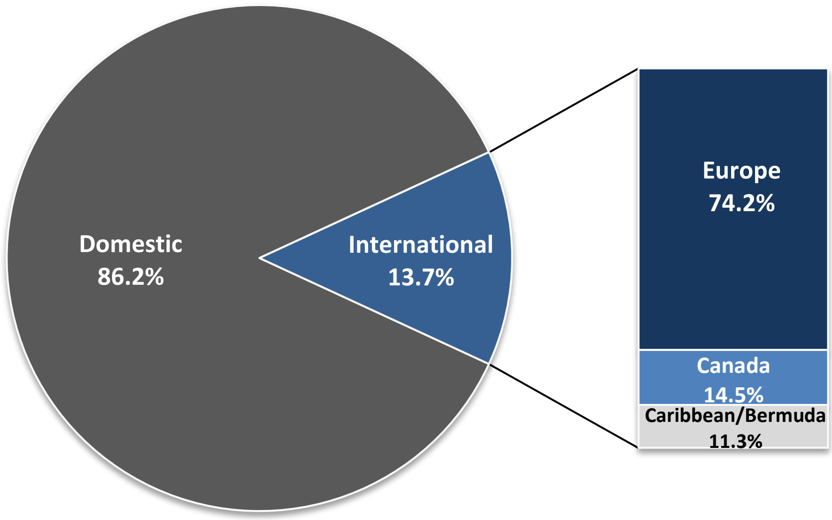


Source: Massport.
Note: United Airlines totals in this chart include Continental Airlines beginning in 2011 (following 2010 merger), Delta Air Lines totals include Northwest Airlines beginning in 2010 (following 2009 merger), and US Airways include America West Airlines beginning in 2005 (following 2005 merger). Totals for American Airlines, Delta Air Lines, United Airlines and US Airways include Delta Shuttle, US Airways Shuttle, and contract carriers doing business as Delta Connection, United Express, US Airways Express, American Eagle, or American Connection.

The number of international air passengers also increased in 2011, following declines in the previous three years. International demand had been negatively impacted by the global 2008/2009 economic recession and is only recently beginning a modest recovery. International passenger traffic at Logan Airport increased by 7.6 percent in 2011, compared to a decline of 0.4 percent in 2010 from 2009 levels. Total international passengers at 4.0 million in 2011 remain below the 4.5 million international passenger level reached in 2000.

Figure 2-3 shows the distribution of Logan Airport passengers by market segment. Europe was the dominant international destination market, accounting for 74.2 percent of international traffic and 10.2 percent of total traffic at Logan Airport. Passenger traffic to Europe was up 10.0 percent from 2010 levels, compared to an increase of 2.6 percent between 2009 and 2010. Canada and the Bermuda/Caribbean region accounted for 14.5 percent and 11.3 percent of international passengers respectively in 2011. Travel to Canada increased by 10.7 percent compared to an increase of 14.3 percent in 2010. Traffic to the Bermuda/Caribbean market continued to decline, decreasing by 8.1 percent in 2011, following a 23.5 percent decline in 2010. This was the result of Caribbean service cuts and passenger reductions by American Airlines and US Airways.

Figure 2-3 Distribution of Logan Airport Passengers by Market Segment, 2011



Source: Massport.
Note: GA accounted for 0.4 percent of Logan Airport Passengers in 2011.

Aircraft Operation Levels in 2011

This section reports on aircraft operations levels for Logan Airport, including passenger aircraft operations, GA operations, all-cargo aircraft operations, and aircraft load factors for 2011.

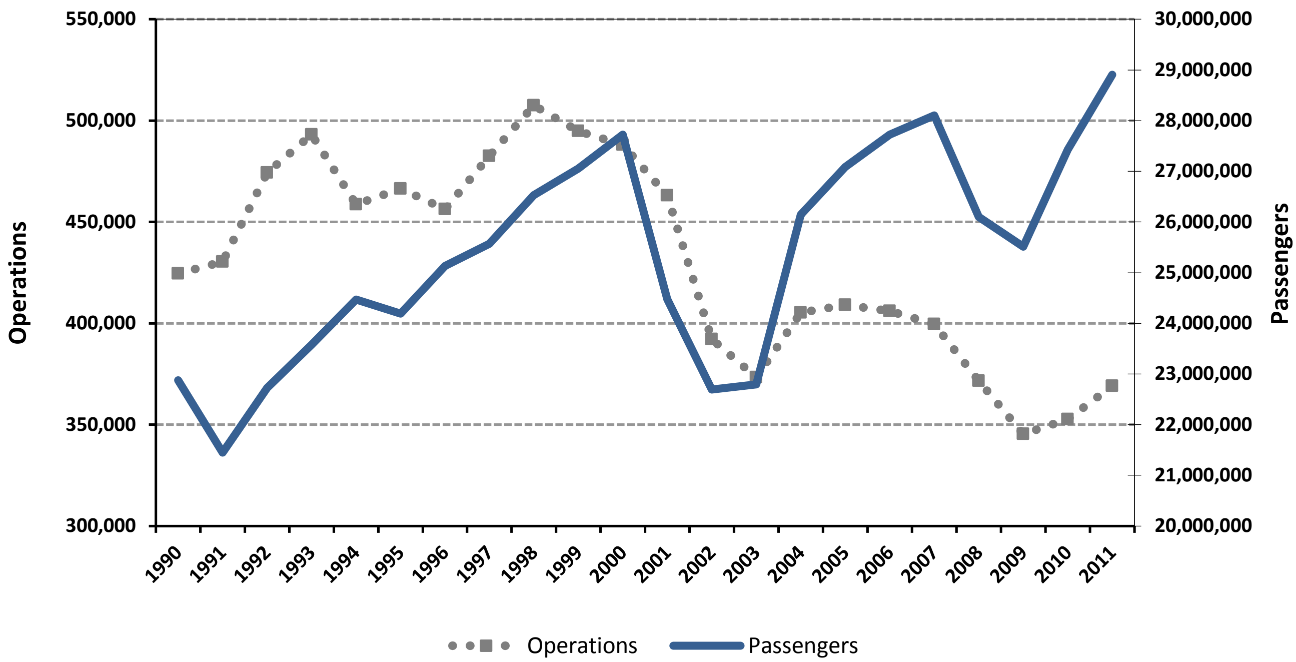
Logan Airport Aircraft Operations

The total number of aircraft operations at Logan Airport (including passenger, GA and all-cargo) increased from 352,643 operations in 2010 to 368,987 operations in 2011. This represents an increase in aircraft operations of 4.6 percent in 2011 (Table 2-2), compared to an increase of 2.1 percent in 2010. Aircraft operations continued to increase at a slower rate than passenger levels, as a result of passenger load factors continuing to increase. Figure 2-4 depicts passengers and operations data since 1990, and shows how passenger levels have grown at Logan Airport while overall aircraft operations have decreased to levels prior to 1990. This trend reflects reductions in the use of small aircraft since 2000 and tighter capacity control and increased efficiencies on the part of airlines.

Table 2-2 Logan Airport Aircraft Operations, 2000-2011							
Category	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Total Aircraft Operations	**487,996**	**463,124**	**392,079**	**373,304**	**405,259**	**409,067**	**406,119**
Operations by Type and Aircraft Class							
Passenger Jet	254,968	233,431	202,313	185,166	212,723	201,502	206,467
Passenger Regional Jet	37,600	70,533	93,493	100,336	102,039	113,886	110,554
Passenger Non-Jet	147,913	119,103	60,663	49,520	49,672	52,114	48,663
Total Passenger Operations	**440,481**	**423,067**	**356,469**	**335,022**	**364,434**	**367,502**	**365,684**
GA Jet Operations	20,595	15,056	16,586	20,480	23,085	25,806	26,566
GA Non-Jet Operations	14,638	13,683	9,010	8,180	8,151	6,846	4,878
Total GA Operations	**35,233**	**28,739**	**25,596**	**28,660**	**31,236**	**32,652**	**31,444**
Cargo Jet	11,788	11,156	10,012	9,620	9,589	8,913	8,493
Cargo Non-Jet	494	162	2	2	0	0	498
Total Cargo Operations	**12,282**	**11,318**	**10,014**	**9,622**	**9,589**	**8,913**	**8,991**
Category	**2007**	**2008**	**2009**	**2010**	**2011**	**Percent Change (2010-2011)**	**Percent Change (2000-2011)**
Total Aircraft Operations	**399,537**	**371,604**	**345,306**	**352,643**	**368,987**	**4.6%**	**(2.5%)**
Operations by Type and Aircraft Class							
Passenger Jet	220,135	209,931	205,341	214,307	223,083	4.1%	(1.2%)
Passenger Regional Jet	88,500	80,589	70,198	66,498	61,704	(7.2%)	4.6%
Passenger Non-Jet	53,663	48,595	50,867	50,882	49,700	(2.3%)	(9.4%)
Total Passenger Operations	**362,298**	**339,115**	**326,406**	**331,687**	**334,487**	**0.8%**	**(2.5%)**
GA Jet Operations	22,925	17,750	8,988	11,430	21,129	84.9%	0.2%
GA Non-Jet Operations	5,707	6,070	3,254	3,252	7,101	118.3%	(6.4%)
Total GA Operations	**28,632**	**23,820**	**12,242**	**14,682**	**28,230**	**92.3%**	**(2.0%)**
Cargo Jet	8,084	8,149	5,431	5,332	5,053	(5.2%)	(7.4%)
Cargo Non-Jet	523	520	1,227	942	1,217	29.2%	8.5%
Total Cargo Operations	**8,607**	**8,669**	**6,658**	**6,274**	**6,270**	**(0.1%)**	**(5.9%)**

Source: Massport
Notes: Jet includes the Embraer E-190, which is a regional jet configured with 88-100 seats, but is similar in size to some traditional narrow-body jets.
Numbers in parenthesis () indicate negative number.

Figure 2-4 Logan Airport Historical Air Passenger and Aircraft Operations, 1990-2011



Passenger Operations

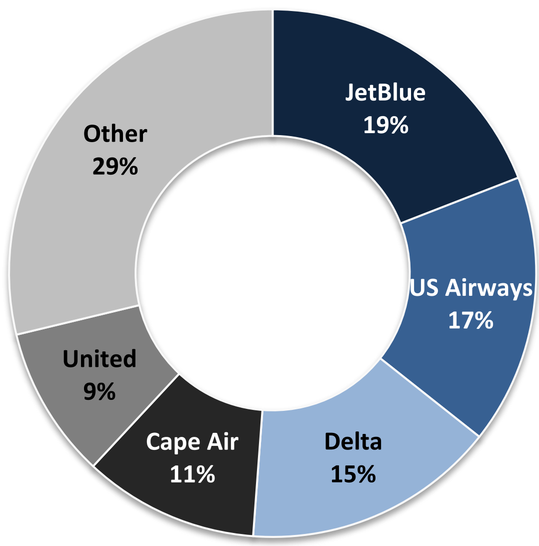
Passenger aircraft operations, which represented 90.7 percent of total aircraft operations at Logan Airport, increased by 0.8 percent in 2011 compared to 2010. The dominant carriers at Logan Airport based on the number of aircraft operations are shown in Figure 2-5. Passenger RJ operations (jet aircraft with fewer than 100 seats) and passenger non-jet operations continued to decrease. RJ operations, which have declined annually since 2006, dropped another 7.2 percent in 2011.[5] Passenger operations in non-jet aircraft (turboprop or piston aircraft) declined by 2.3 percent in 2011. Passenger jet operations increased 4.1 percent from 214,307 operations in 2010 to 223,083 operations in 2011. The change in the aircraft mix of passenger flights at Logan Airport over the past eleven years is shown in Figure 2-6. RJs accounted for 18 percent of total passenger operations in 2011, compared to 31 percent at the peak level in 2005. Similarly, non-jets have declined from 34 percent in 2000 to 15 percent in 2011.

The decrease in RJ and non-jet passenger operations at Logan Airport was a result of continued service cutbacks by legacy carriers such as Delta Air Lines, American Airlines, and US Airways. While the legacy carriers also implemented significant cuts in passenger jet operations, these cuts were more than offset by increases associated with JetBlue Airways' and Southwest Airlines' service expansion.

With RJ operations, there has been a trend of airlines retiring the smaller RJs with 30 to 50 seats, which have not proven to be cost-effective in the current high fuel price environment, and a trend of increasing use of larger RJs or turboprops with 60 to 90 seats. In recent years, the use of larger RJs with 60 to 90 seats has increased steadily at Logan Airport from approximately 1.1 percent share of total RJ operations in 2000 to 50.6 percent in 2010.

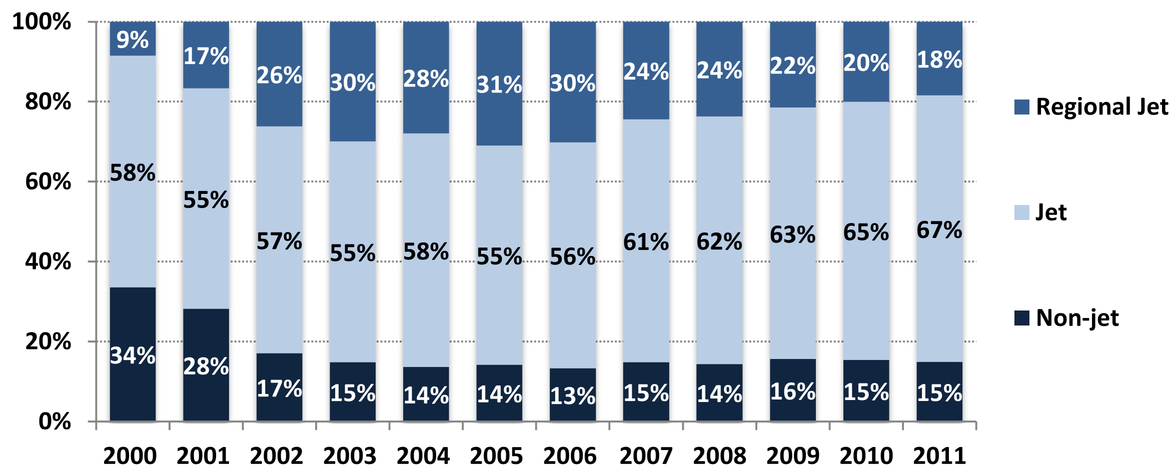
5 In this report, the term regional jet refers to small jet aircraft with fewer than 90 seats. The Embraer-190, operated by JetBlue Airways and U.S. Airways at Logan Airport, carries up to 100 and 99 passengers respectively, and is considered a jet.

Figure 2-5 Dominant Passenger Carriers at Logan Airport by Aircraft Operations, 2011



Notes: United Airlines figure includes Continental Airlines (2010 merger).
Totals for American Airlines, Delta Air Lines, United Airlines and US Airways include all regional affiliates and contract carriers.
"Other" category includes all other carriers which have a smaller portion of aircraft operations at Logan Airport. This category includes but is not limited to United Airlines, Southwest, Continental, AirTran, Air Canada, Porter Airlines, British Airways and Lufthansa, which provide year-round and seasonal service to Logan Airport.

Figure 2-6 Passenger Aircraft Operations at Logan Airport by Aircraft Type, 2000-2011



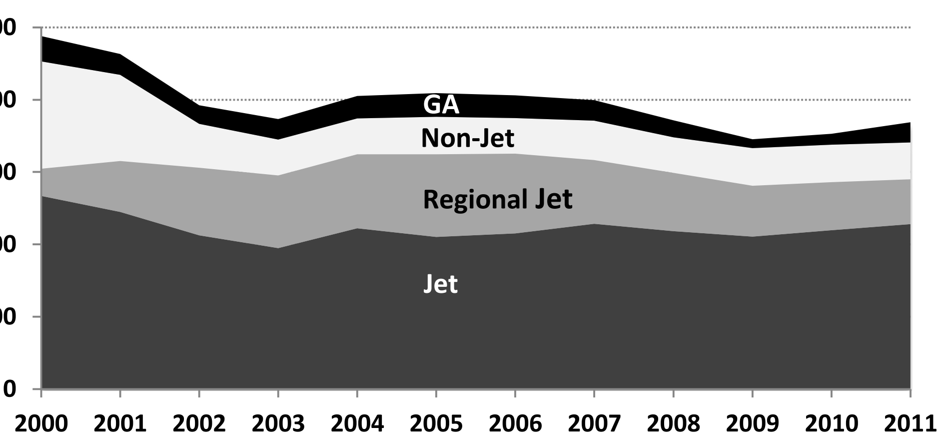
Source: Massport

JetBlue Airways, US Airways, Delta Air Lines, Cape Air, and the new consolidated United Airlines/ Continental Airlines were the dominant carriers at Logan Airport in 2011 based on the number of aircraft operations.[6] JetBlue Airways accounted for approximately 63,910 operations in 2011, overtaking US Airways in annual operations at Logan Airport. US Airways accounted for 55,338 operations and Delta Air Lines ranked third with 51,955 operations. Cape Air and United Airlines ranked 4th and 5th, with 35,940 operations and 31,181 operations respectively.

General Aviation Operations

GA is defined as all aviation activity other than commercial airline and military operations. It encompasses a variety of aviation activities including corporate/business aviation, private business jet charters, law-enforcement, and emergency medical/air ambulance services at Logan Airport. GA operations are conducted with a diverse group of aircraft ranging from gliders and single-engine piston driven aircraft, to high-performance, long-range business jet aircraft. GA activity began to rebound at Logan Airport in 2010 following a steep decline during 2008-2009 due to high fuel prices and economic recession. Businesses increased their travel and use of GA transportation as the economy improved. GA operations grew 92.3 percent in 2011, following a 19.9 percent increase in 2010. GA operations totaled 28,230 operations in 2011, up from 14,682 operations in 2010, but still below the 2005 level of 32,650 GA operations. In 2011, GA operations accounted for 7.7 percent of aircraft activity at Logan Airport. In comparison, Hanscom Field accommodated 160,840 GA operations in 2011, with GA activity accounting for 99 percent of Hanscom's aircraft activity. Hanscom Field remains the primary GA airport for the Greater Boston region, accommodating close to six times the number of GA operations than at Logan Airport. Figure 2-7 depicts changes in Logan Airport aircraft operations by category since 2000.

Figure 2-7 Aircraft Operations at Logan Airport by Aircraft Class, 2000-2011



Source: Massport.
Notes: Jet, regional jet, and non-jet operations are associated with commercial passenger and all-cargo airlines.
GA operations also include jet and non-jet aircraft, but are associated with private charter and corporate use.

6 Airline rank is based on total number of a carrier's operations for carrier "families," including activity for all code share partners and regional subsidiaries.

All-Cargo Operations
All-cargo operations, which are also strongly linked to the economy, showed little change with a decrease of 0.1 percent in 2011. This compares to a decline of 5.8 percent in 2010. The all-cargo segment represents less than 2 percent of aircraft activity at Logan Airport with approximately 6,270 operations in 2011.

Passengers Per Aircraft and Load Factors
The average number of passengers per aircraft operation increased in 2011, continuing the trend seen over the past decade. The average number of passengers per aircraft operation can be an indicator of the average size of aircraft using Logan Airport, and/or an indicator of changes in average aircraft load factor. In 2011, Logan Airport operations accommodated an average of 78.3 passengers per flight compared to 77.8 passengers in 2010 (Table 2-3). The average number of passengers per flight has risen by 37.9 percent since 2000, when the average number of passengers per flight was 56.8. The increasing number of passengers per flight is a reflection of the airlines' continued emphasis on restrained capacity growth, a shift away from smaller aircraft, and increasing passenger load factors. Load factors are the percentage of seats occupied by passengers, and are a common industry indicator of how occupied an aircraft is compared to the available seats. The average load factor for flights from Logan Airport has historically tracked below the national average. In 2011, Logan Airport's average domestic load factor increased to 77.5 percent, up from 76.8 percent in 2010. The national average domestic load factor also increased, rising to 78.8 percent in 2011, compared to 78.0 percent in 2010.[7] Changes in passengers per operation and load factor are shown in Figure 2-8.

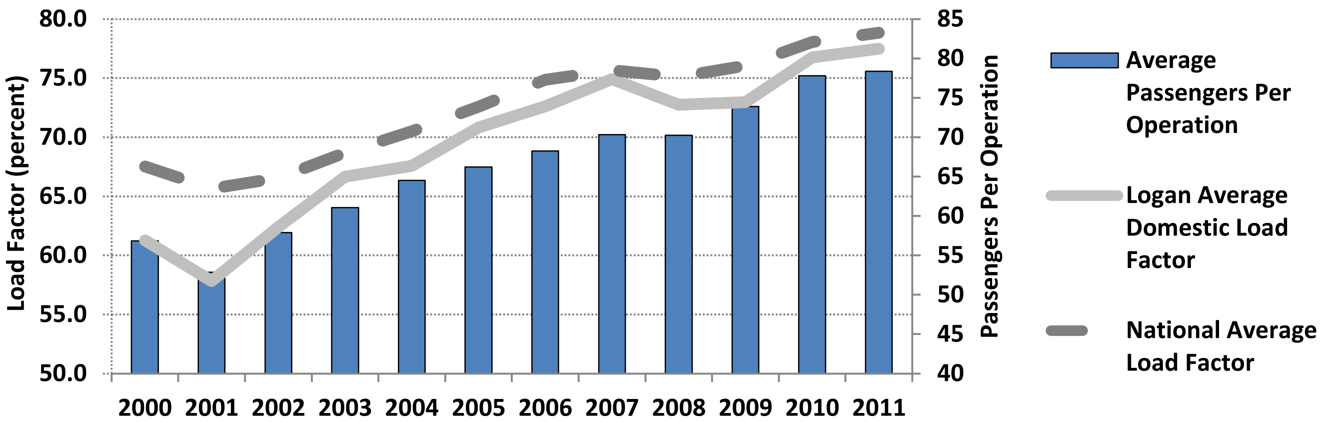
Table 2-3 Air Passengers and Aircraft Operations, 2000-2011

Year	Air Passengers	Percent Change from Previous Year	Aircraft Operations	Percent Change	Average Number of Passengers per Operation	Net Change from Previous Year	Logan Average Domestic Load Factor	Net Change from Previous Year
2000	27,726,833	2.5%	487,996	(1.4%)	56.8	2.1	61.3%	0.4
2001	24,474,930	(11.7%)	463,125	(5.1%)	52.8	-4.0	57.8%	-3.4
2002	22,696,141	(7.3%)	392,079	(15.3%)	57.9	5.0	62.4%	4.6
2003	22,791,169	0.4%	373,304	(4.8%)	61.1	3.2	66.6%	4.2
2004	26,142,516	14.7%	405,258	8.6%	64.5	3.5	67.6%	0.9
2005	27,087,905	3.6%	409,066	0.9%	66.2	1.7	70.8%	3.2
2006	27,725,443	2.4%	406,119	(0.7%)	68.3	2.1	72.6%	1.6
2007	28,102,455	1.4%	399,537	(1.6%)	70.3	2.1	74.9%	2.3
2008	26,102,651	(7.1%)	371,604	(7.0%)	70.2	(0.1)	72.8%	(2.2)
2009	25,512,086	(2.3%)	345,306	(7.1%)	73.9	3.6	73.0%	0.2
2010	27,428,962	7.5%	352,643	2.1%	77.8	3.9	76.8%	3.8
2011	28,907,938	5.4%	368,987	4.6%	78.3	0.6	77.5%	0.7

Sources: Massport; U.S. Department of Transportation (DOT), T100 Database
Note: Numbers in parenthesis () indicate negative number.

7 U.S. DOT, T100 Database.

Figure 2-8 Passengers per Aircraft Operation and Load Factor, 2000-2011



Airline Passenger Service in 2011

Airlines can adjust service at an airport or on a specific route in two ways: changing the number of flights operated, or changing the size of the aircraft. Changes in flight frequency and changes in aircraft size both affect the number of seats available to passengers, also known as seat capacity. Airline services are therefore typically discussed in terms of seat capacity as well as the number of flight departures.[8] This section examines changes in airline departures and seat capacity at Logan Airport in 2011 and provides an overview of new and discontinued routes.

Service Developments at Logan Airport

In 2011, twenty-eight airlines provided scheduled passenger service from Logan Airport to 102 non-stop destinations. The major changes in Logan Airport's scheduled passenger services in 2011 are described below. The average non-stop stage length (the average length of non-stop flights) of scheduled domestic flights from Logan Airport changed varied slightly in 2011 to 751 miles from 752 miles in 2010. The average non-stop stage length of scheduled international flights increased from 1,620 miles in 2010 to 1,699 miles in 2011.

Changes in Domestic Passenger Service

As shown in Table 2-4, the total number of domestic flights at Logan Airport increased by only 0.5 percent in 2011. Scheduled domestic jet carrier flights, which account for 70 percent of domestic flights, increased 3.1 percent from 2010. Domestic regional/commuter flights fell by 5.2 percent in 2011, and domestic charter flights increased 1.2 percent.

LCC operations at Logan Airport grew by 14.6 percent in 2011, increasing from 85,200 operations in 2010 to 97,620 operations in 2011. LCCs now account for 46.6 percent of scheduled domestic jet operations and 32.6 percent of total domestic operations. JetBlue Airways, the dominant LCC at Logan Airport, continued its robust expansion, increasing its domestic operations by 21.5 percent from 49,980 operations in 2010 to 60,745 operations in 2011. Southwest Airlines also continued to expand, growing 26.9 percent from 13,730 operations in 2010 to 17,410 operations in 2011.[9]

8 A departure is an aircraft take-off at an airport. While aircraft operations include both departures and arrivals, airline services are typically described in terms of departures, as the number of scheduled departures generally equals the number of scheduled arrivals. Changes in departures translate to changes in overall operations.

9 Southwest Airlines began service at Logan Airport in August 2009.

Table 2-4	Domestic Air Passenger Operations by Airline Category, 2000-2011						
Category	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Total Jet Operations	**233,993**	**208,703**	**179,388**	**162,252**	**193,599**	**190,991**	**199,281**
Legacy Carriers	222,564	198,057	166,941	135,607	146,411	137,422	141,704
Low-Cost Carriers	11,429	10,646	12,447	26,645	47,188	53,569	57,577
Regional/Commuter	**160,041**	**167,631**	**137,037**	**134,108**	**130,272**	**137,203**	**130,298**
Charter Carriers	**1,008**	**769**	**609**	**467**	**423**	**324**	**369**
Total Domestic	**395,042**	**377,103**	**317,034**	**296,827**	**324,294**	**328,519**	**329,948**
Category	**2007**	**2008**	**2009**	**2010**	**2011**	**Percent Change (2010-2011)**	**Avg. Annual Growth (2000-2011)**
Total Jet Operations	**198,879**	**189,739**	**184,181**	**203,081**	**209,377**	**3.1%**	**(1.0%)**
Legacy Carriers	143,465	136,285	124,147	117,877	111,761	(5.3%)	(6.1%)
Low-Cost Carriers	55,414	53,454	60,034	85,204	97,616	14.6%	21.5%
Regional/Commuter	**124,014**	**112,881**	**107,615**	**94,535**	**89,586**	**(5.2%)**	**(5.1%)**
Charter Carriers	**570**	**582**	**412**	**501**	**507**	**1.2%**	**(6.1%)**
Total Domestic	**323,463**	**303,202**	**292,208**	**298,117**	**299,470**	**0.5%**	**(2.5%)**

Source: Massport.
Notes: LCCs serving Logan Airport in 2011 included AirTran, Frontier, JetBlue Airways, Southwest Airlines, Spirit Airlines, Sun Country Airlines, and Virgin America. Numbers in parenthesis () indicate negative number.

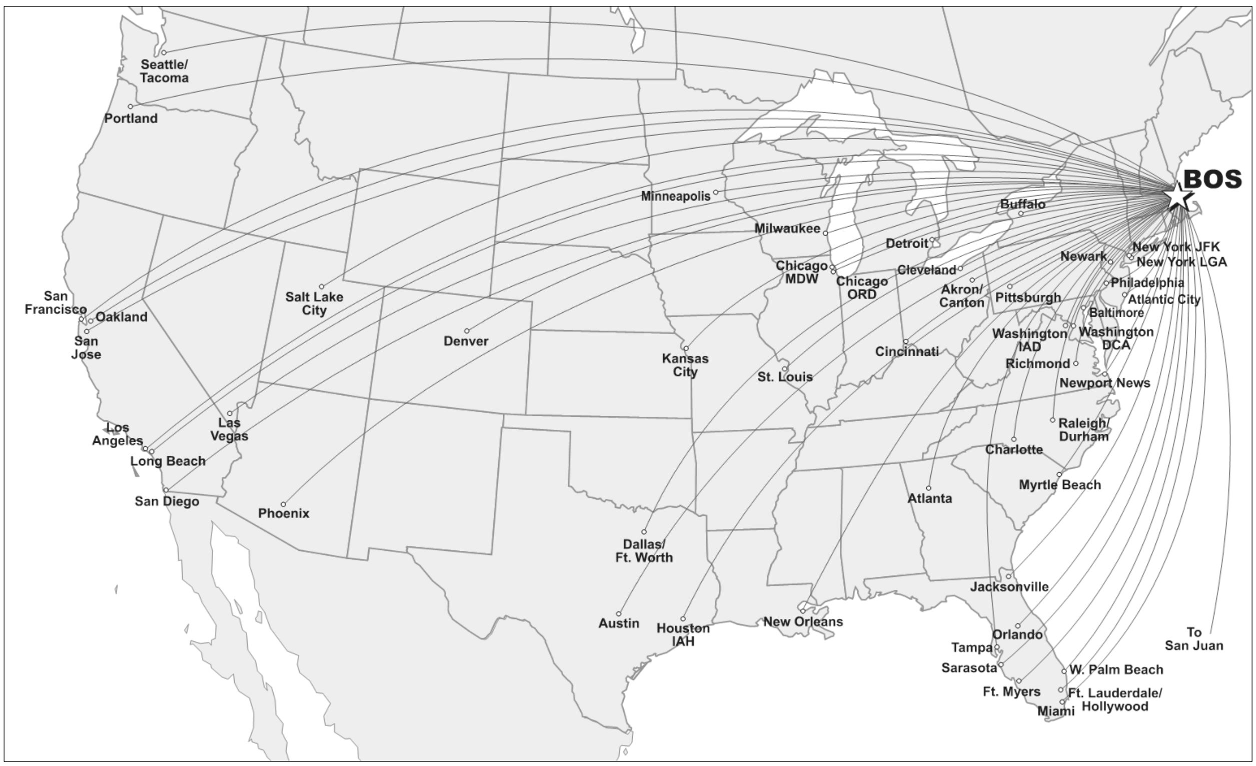
New non-stop service in a number of domestic markets balanced service cutbacks to other domestic markets in 2011. New service was introduced from Logan Airport to the following markets:

- JetBlue Airways continued its rapid expansion at Logan Airport, introducing new three times daily Embraer E-190 service to Newark, NJ. JetBlue also began summer seasonal service to Portland, OR in May 2011.
- In April 2011, Delta Air Lines introduced non-stop RJ service to Norfolk, VA and Pittsburgh, PA. Delta RJ service to Kansas City, MO was introduced in June 2011.
- Spirit Airlines began daily non-stop service to Chicago's O'Hare International Airport in August 2011.
- Notable domestic service increases at Logan Airport in 2010 that contributed to a rise in passenger levels in 2011 included the following:
  - JetBlue Airways increased scheduled services to several markets including Washington National Airport, Orlando, FL and Raleigh/Durham, NC.
  - Logan Airport continued to benefit from Southwest Airlines' high-frequency services to Philadelphia, PA, launched in the summer of 2010. Southwest Airlines also increased flight frequencies to Baltimore, MD.
  - US Airways increased narrow-body capacity in the Philadelphia, PA market, in addition to providing high-frequency Embraer 70 to 100 seat jet services.
- While JetBlue Airways and other LCCs expanded service at Logan Airport, legacy carriers continued to tighten capacity in 2011.

- American Airlines discontinued service to four markets earlier in 2010: Columbus, OH, Raleigh/Durham, NC, St. Louis, MO, and Washington National Airport.
- Following its merger with Northwest Airlines, Delta Air Lines consolidated operations at Logan Airport, discontinuing service to three Florida destinations in 2010: Fort Myers, Tampa, and West Palm Beach. The carrier kept capacity largely flat in other markets and reduced frequencies to New York's JFK International Airport and Nevada's Salt Lake City International Airport.

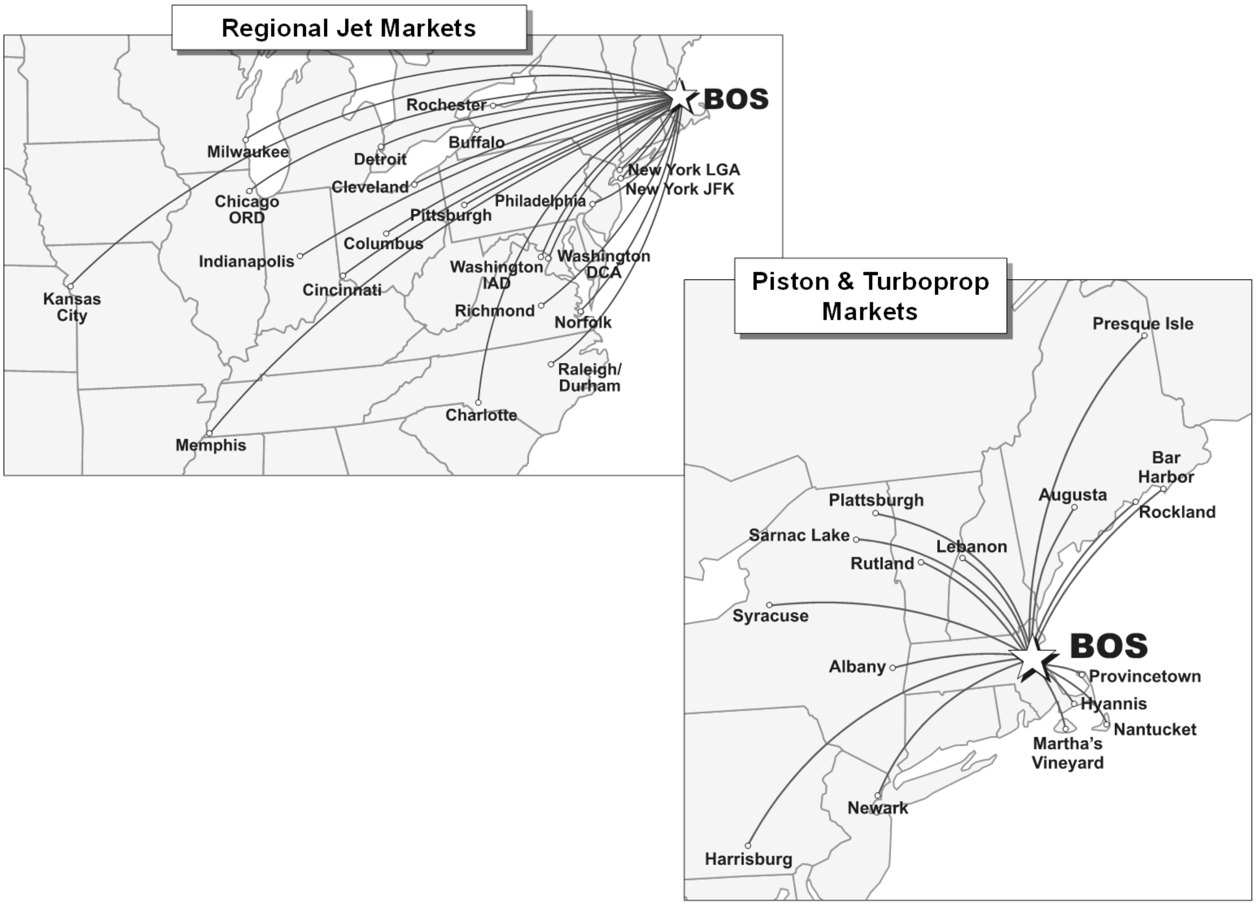
A complete listing of all changes in scheduled departures by domestic destination is in *Appendix E, Activity Levels*. Logan Airport's scheduled domestic large jet and domestic regional services in 2011 are illustrated in Figure 2-9 and Figure 2-10.

Figure 2-9 Domestic Non-stop Large Jet Markets Served from Logan Airport, August 2011



Source: Official Airline Guide Market Files.

Figure 2-10 Domestic Passenger Non-stop Regional Markets Served from Logan Airport, August 2011



Source: Official Airline Guide Market Files.

Changes in International Passenger Service

Total international passenger operations at Logan Airport increased 5.5 percent in 2011, compared to a decline of 1.8 percent in 2010. This marked the first year of international passenger operation growth after declines over the past three years. International passenger operations totaled 35,420 operations in 2011, as summarized in Table 2-5 (for details on the changes in operations by carrier, see *Appendix E, Activity Levels*). Passenger operations to the Europe/Middle East market increased by 15.9 percent in 2011. The Europe/Middle East market remains the second largest international market in terms of operations and the largest in passengers. The Canadian market, Logan Airport's largest international destination region in terms of aircraft operations, decreased slightly by 0.7 percent. Operations to the Bermuda/Caribbean market declined by 1.7 percent. Logan Airport's scheduled international air service markets are shown in Figure 2-11.

Table 2-5 International Passenger Operations by Market Segment, 2000-2011

Category	2000	2001	2002	2003	2004	2005	2006
Scheduled	**43,021**	**44,060**	**38,217**	**36,882**	**38,588**	**37,575**	**35,003**
Europe/Middle East	13,435	13,206	12,278	11,408	12,085	12,206	11,954
Canada	26,067	24,898	20,750	19,332	18,639	18,914	16,893
Bermuda/Caribbean[1]	3,205	5,956	5,035	5,808	6,838	5,594	5,710
Central/South America	314	0	154	334	1,026	861	446
Non-Scheduled	**2,141**	**1,892**	**1,184**	**1,313**	**1,467**	**1,068**	**727**
Total	**45,162**	**45,952**	**39,401**	**38,195**	**40,055**	**38,643**	**35,730**

Category	2007	2008	2009	2010	2011	Percent Change (2010-2011)	Avg. Annual Growth (2000-2011)
Scheduled	**38,308**	**35,538**	**33,878**	**33,266**	**35,118**	**5.6%**	**(1.8%)**
Europe/Middle East	13,127	13,366	12,960	12,750	14,780	15.9%	0.9%
Canada	18,859	15,996	14,815	16,399	16,290	(0.7%)	(4.2%)
Bermuda/Caribbean[1]	6,191	6,176	6,103	4,116	4,046	(1.7%)	2.1%
Central/South America	131	0	0	0	0	–	–
Non-Scheduled	**527**	**375**	**320**	**305**	**300**	**(1.6%)**	**(16.4%)**
Total	**38,835**	**35,913**	**34,198**	**33,570**	**35,418**	**5.5%**	**(2.2%)**

Source: Massport.
Notes: Numbers in parenthesis () indicate negative number.
1 Includes Puerto Rico and U.S. Virgin Islands.

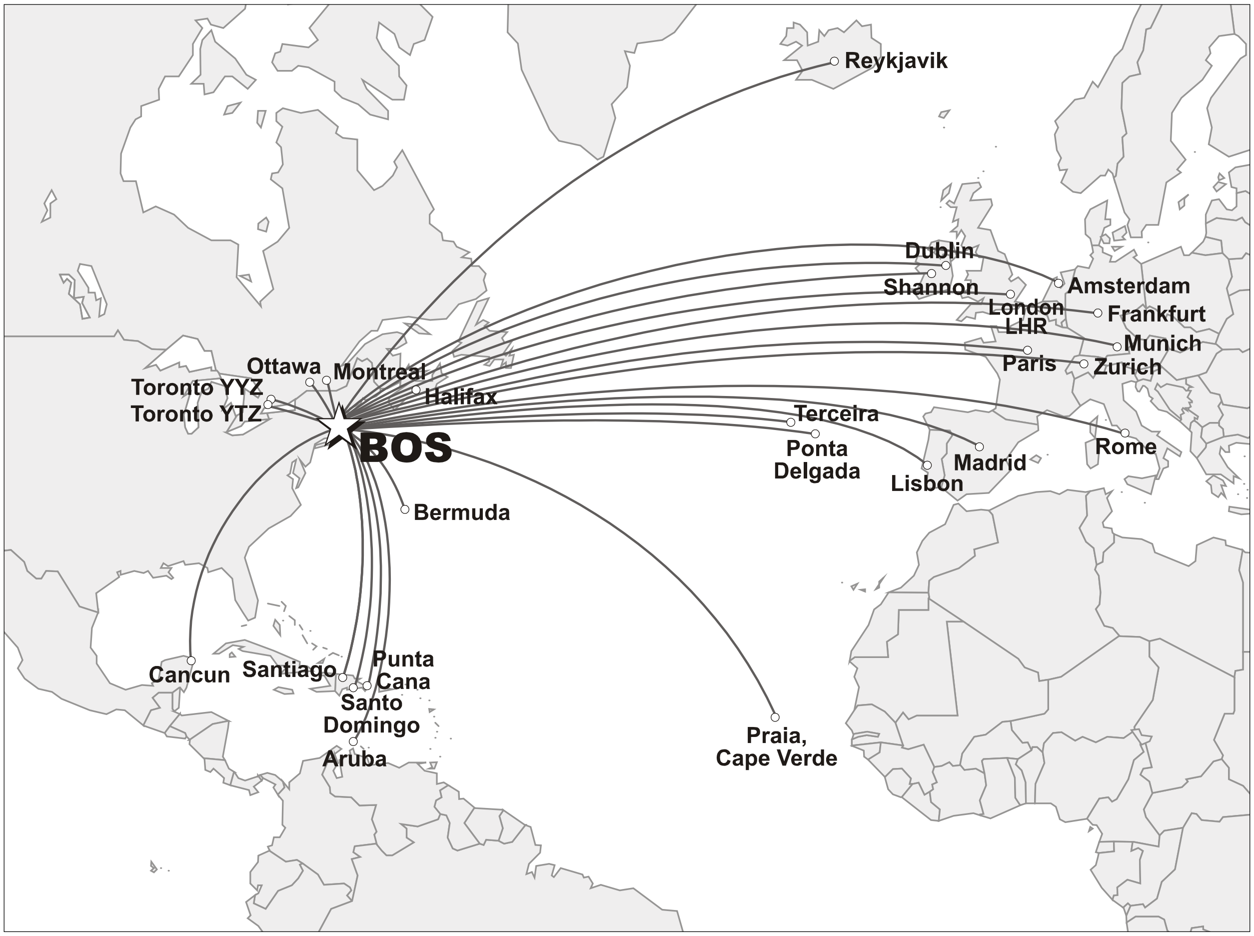
New and expanded international passenger service at Logan Airport in 2011 included the following:

- Delta Air Lines added significant international capacity at Logan Airport in 2011. Delta Air Lines entered the Boston-London Heathrow market in March 2011 with twice-daily non-stop service, adding to the non-stop service provided by British Airways and American Airlines. Delta also introduced seasonal summer service to Paris, beginning daily non-stop service in March 2011. The carrier also introduced RJ services to Toronto Pearson Airport in November 2011, returning to a route it has not served since the late 1990s.
- JetBlue Airways continued its expansion into the Caribbean markets, introducing non-stop service to Santiago (Dominican Republic) in June 2011. JetBlue Airways also initiated seasonal service to Saint Thomas (U.S. Virgin Islands), as well as seasonal service to Providenciales (Turks and Caicos Islands). JetBlue Airways further increased scheduled frequencies to San Juan, Puerto Rico.
- Iceland Express launched seasonal service to Reykjavik in June 2011.

Service cuts in the Caribbean markets were implemented by legacy carriers, even as JetBlue Airways expanded in the Caribbean, resulting in the overall decline in aircraft operations to the Caribbean in 2011. International service reductions at Logan Airport include the following:

- US Airways discontinued all of its international service from Logan Airport between 2010 and 2011, cutting service to Aruba, Grand Cayman, Montego Bay (Jamaica), Nassau (Bahamas), Providenciales, Punta Cana (Dominican Republic), Saint Thomas, and San Juan, Puerto Rico.
- American Airlines had discontinued seasonal service to Aruba and Providenciales in 2010. In 2011, the carrier also discontinued non-stop services to San Juan and Santo Domingo.

Figure 2-11 International Non-stop Markets Served from Logan Airport, August 2011



Source: Official Airline Guide Market Files.

Cargo Activity Levels in 2011

In 2011, Logan Airport ranked 25th among U.S. airports in total cargo volume.[10] Air cargo is carried in the belly compartments of passenger aircraft or by dedicated all-cargo carriers, such as FedEx, UPS, and DHL in all-cargo aircraft. The express/small package segment dominates Logan Airport cargo activity, accounting for 62.9 percent of the total non-mail cargo volume. Table 2-6 shows all-cargo aircraft operations and cargo volumes at Logan Airport since 2000.

10 Airports Council International, 2011 North American Air Traffic Report.

In 2011, the number of all-cargo operations at Logan Airport remained constant, decreasing by 0.1 percent from 2010. Total cargo volume, including mail, decreased by 3.1 percent in 2011 (Table 2-6). Overall, all-cargo operations at Logan Airport have declined by approximately 5.9 percent per year since 2000, while cargo volume has declined by approximately 5.6 percent per year since 2000. A number of factors are responsible for the decline in cargo shipments (including freight, express and non-express mail and packages) at Logan Airport, as well as nationally, over the past several years. Cargo carriers, particularly the integrators that provide door-to-door delivery services, have significantly increased their use of trucks to move cargo in shorter haul markets because it is more cost-effective than air transport. In addition, the greater acceptance and use of the internet and e-mail has greatly reduced mail volumes overall.

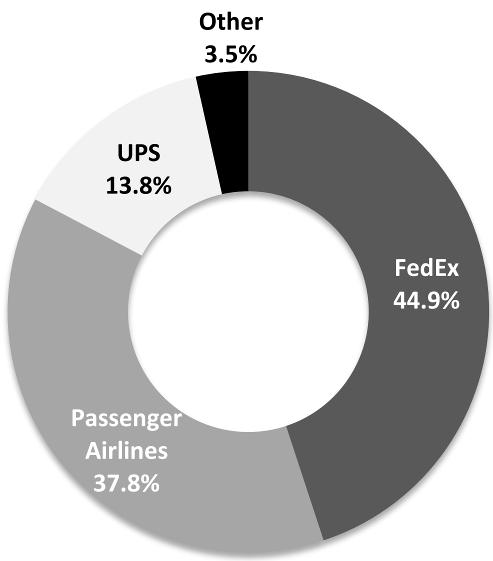
FedEx carried 44.9 percent of the total cargo volume through Logan Airport in 2011 and was the 14th largest air carrier at the Airport in terms of total flights. UPS was the next largest cargo operator and accounted for 13.8 percent of Logan Airport's cargo volume in 2011. Passenger airlines carried 37.8 percent, or 210 million pounds, of Logan Airport's cargo as belly cargo in 2011, compared to 345 million pounds that was shipped on all-cargo carriers. These numbers are presented in Figure 2-12.

Table 2-6 Cargo and Mail Operations and Volume, 2000-2011

	2000	2001	2002	2003	2004	2005	2006
All-Cargo Aircraft Operations	12,282	11,318	10,014	9,622	9,589	8,913	8,991
Volume (lbs.)							
Express/Small Packages	484,490,143	428,066,158	465,138,432	474,271,444	478,584,154	472,605,966	422,173,699
Freight	367,857,011	316,731,138	324,471,576	272,566,843	280,690,836	268,911,342	256,894,390
Mail	194,902,513	126,454,080	65,842,827	55,756,993	48,412,006	43,728,414	37,269,744
Total	**1,047,249,667**	**871,251,376**	**855,452,835**	**802,595,280**	**807,686,996**	**785,245,722**	**716,337,833**
	2007	**2008**	**2009**	**2010**	**2011**	**Percent Change (2010-2011)**	**Avg. Annual Growth (2000-2010)**
All-Cargo Aircraft Operations	8,607	8,669	6,658	6,274	6,270	(0.1%)	(5.9%)
Volume (lbs.)							
Express/Small Packages	403,051,494	384,170,303	326,475,030	339,485,424	332,840,847	(2.0%)	(3.4%)
Freight	229,398,281	203,601,999	191,082,152	206,893,979	196,371,936	(5.1%)	(5.5%)
Mail	25,843,366	33,511,097	28,802,366	25,904,205	25,405,865	(1.9%)	(16.9%)
Total	**658,293,141**	**621,283,399**	**546,359,548**	**572,283,608**	**554,618,648**	**(3.1%)**	**(5.6%)**

Source: Massport.
Note: Numbers in parenthesis () indicate negative number.

Figure 2-12 Cargo Carriers – Share of Logan Airport Cargo Volume, 2011



Note: Passenger planes carry cargo as belly cargo (in the belly of planes).

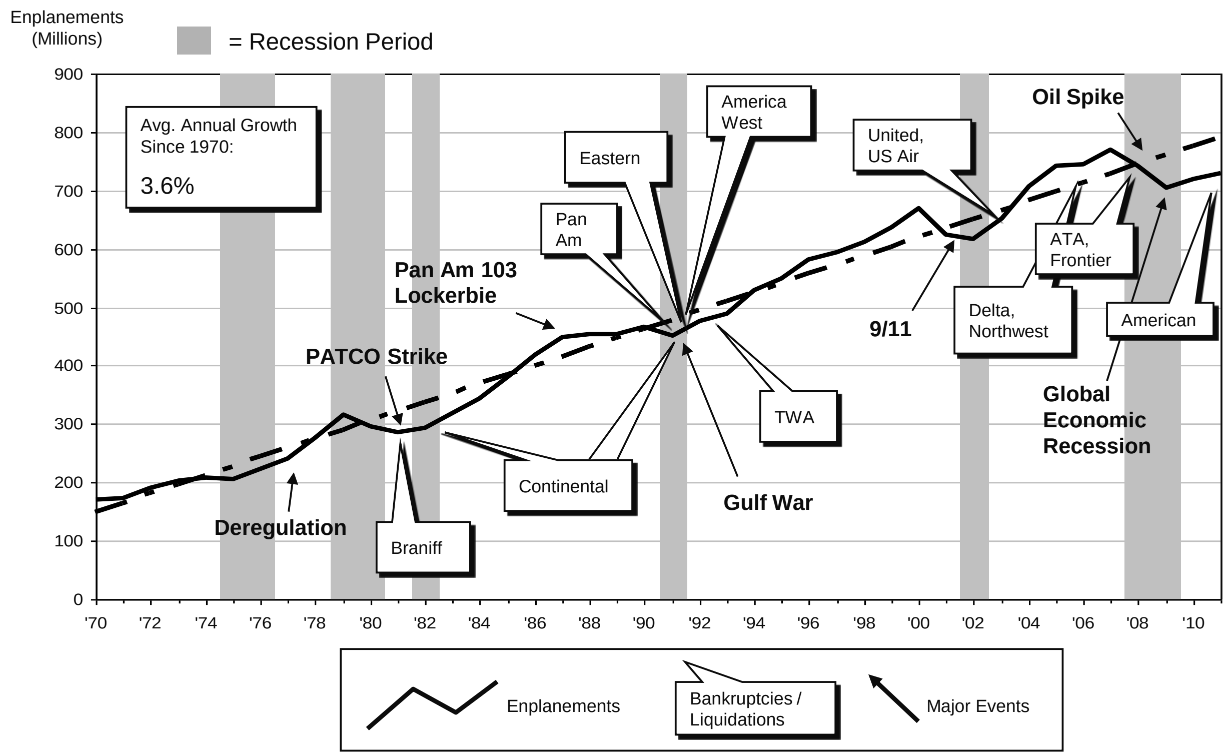
National Aviation Trends

The airline industry is extremely cyclical – constantly affected by economic and political events. Air traffic declines caused by economic recessions and other political "shocks" such as the events of September 11, 2001 have been followed by gradual recovery cycles. As shown in Figure 2-13, the airline industry has experienced significant turmoil since 2000, seeing a wave of airline bankruptcies and reorganizations, a spike in oil prices, as well as the global financial crises of 2008 to 2009. However, the industry continues to recover and growth in air passenger traffic has resumed. From 1970 to 2011, total domestic and international passenger enplanements in the U.S. increased at an average annual rate of 3.6 percent.

Logan Airport has also consistently rebounded from external shocks and periods of weak demand. After the events of September 11, 2001, similar to other airports across the U.S., Logan Airport was affected by significant capacity reductions associated with airline bankruptcy reorganizations and sharply rising fuel prices. Global recession also resulted in declining air travel demand and depressed traffic levels. However, the Airport recovered to achieve new passenger peaks in 2007 and 2011, attributed to a surge of LCC services.

Below are some major trends that have impacted the airline industry, as well as Logan Airport, over the past decade.

Figure 2-13 U.S. Total Passenger Enplanements, 1970-2011



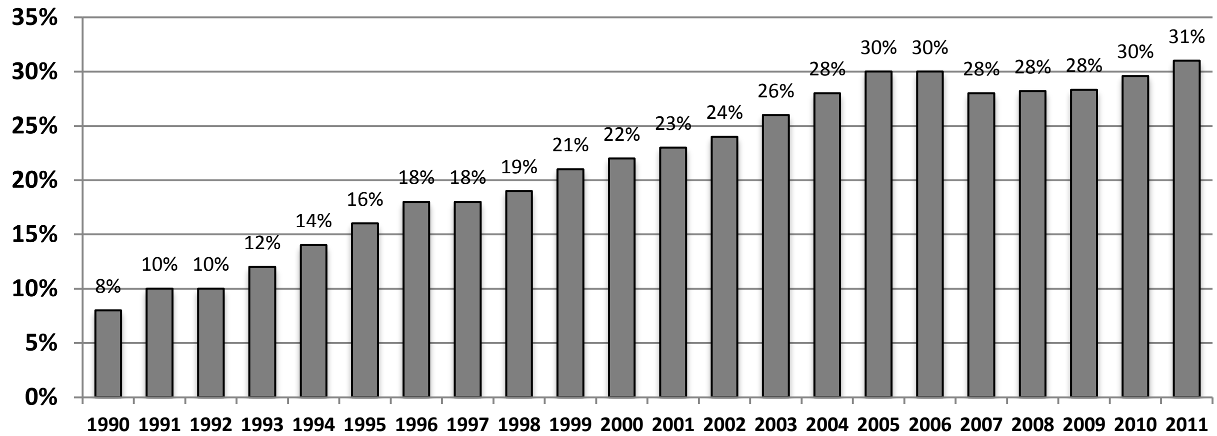
Source: Airlines for America (formerly Air Transport Association); U.S. DOT, T100

Low-Cost Carrier Boom

LCCs rose to prominence earlier this decade, expanding rapidly and gaining share in the domestic market. The formation of carriers, like JetBlue Airways, AirTran Airways, and Frontier Airlines, popularized the no frills, low-cost business model. As shown in Figure 2-14, LCCs provided only approximately 10 percent of domestic seat capacity in the U.S. in 1990. In 2011, LCCs accounted for approximately 31 percent of domestic seats. While rising fuel prices and the economic downturn forced legacy carriers to cut back on domestic capacity and focus on more profitable international flying, LCCs increased their domestic market share. Between 2003 and 2009, LCCs (including Southwest Airlines, JetBlue Airways, AirTran Airways, Frontier Airlines, Spirit Airlines, Virgin American, and Allegiant Air) added a total of approximately 84 billion domestic seat miles to their route systems.[11] In comparison, American Airlines, Delta Air Lines/Northwest Airlines, United Airlines, and US Airways saw a 20 percent average reduction in mainline domestic capacity over the same period for a combined reduction of 85 billion domestic seats miles.[12]

11 U.S. Department of Transportation, T100
12 Ibid.

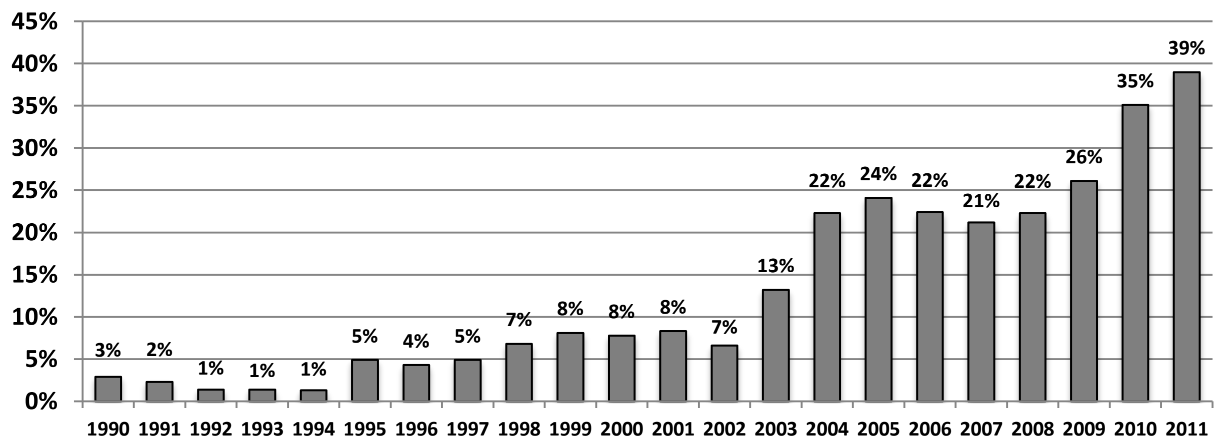
Figure 2-14 Low-Cost Carrier Share of Total U.S. Domestic Seats, 1990-2011



Source: OAG (August 1990 – August 2011)

As shown in Figure 2-15, the LCC market share at Logan Airport has risen dramatically. At the beginning of the last decade, LCCs had only a minimal presence at Logan Airport. At that time, Southwest Airlines served the Boston metropolitan area market through the secondary airports in Warwick, RI and Manchester, NH intentionally bypassing Logan Airport. In 2000, LCCs accounted for only 8 percent of Logan Airport's domestic seat capacity. When JetBlue Airways entered the Logan Airport market in 2004, the LCC domestic seat share rose to 22 percent. The slight decline in the LCC market share in 2006-2008 marked the cessation of Delta Song's operations in mid-2007 and other minor LCC contractions. In 2009-2010, there was another noticeable increase in the LCC share when Southwest Airlines and Virgin America initiated services at Logan Airport. Since then, the LCC market share climbed further as JetBlue Airways expanded by entering markets where mainline carriers reduced services.

Figure 2-15 Low-Cost Carrier Share of Logan Airport Domestic Seats, 1990-2011



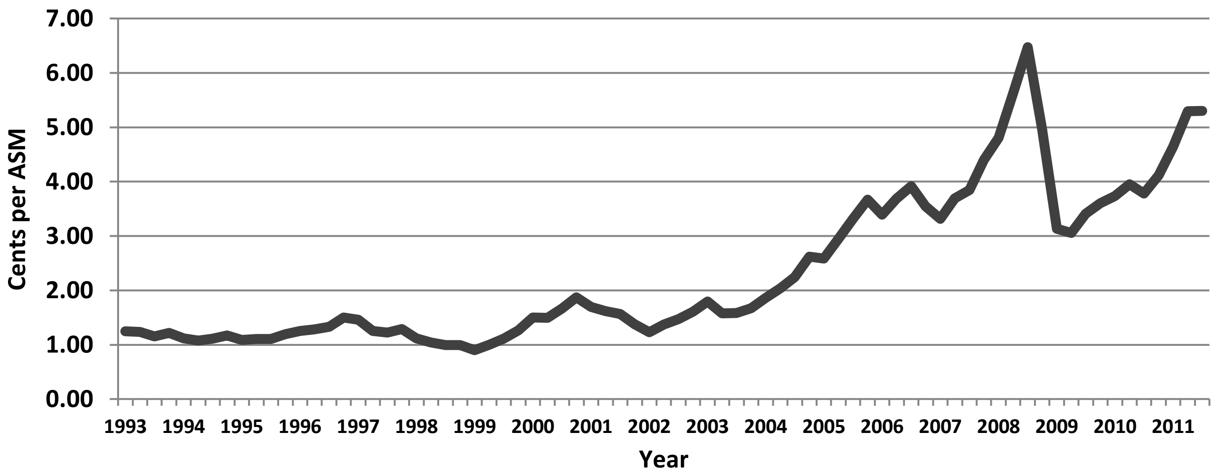
Source: OAG (August 1990 – August 2011)

The rapid growth of LCCs over the past decade was enabled by the lower operating cost advantage LCCs maintained over legacy carriers due to differences in network structure, overhead cost, and crew seniority between the two carrier groups. However, the lines between LCCs and legacy carriers are beginning to blur. The lowering of legacy carrier cost structures and consolidation of carrier networks has allowed legacy carriers to compete on a more equal footing with LCCs.

Rising Fuel Cost Impacts

Fuel cost per available seat mile (ASM) has more than tripled since 2002, rising from approximately 1.5 cents to 5.3 cents per ASM by the third quarter of 2011 (Figure 2-16). In 2008, a spike in crude oil prices drove up jet fuel prices to an unprecedented 6.5 cents per ASM in the third quarter of 2008. Increases in fuel price have offset a large portion of the progress airlines made in cost reduction and capacity optimization following September 11, 2001. Many carriers introduced fuel surcharges in 2008, dropping them as fuel prices fell again at the end of the year. In 2011, fuel prices rose again with unrest in the Middle East.

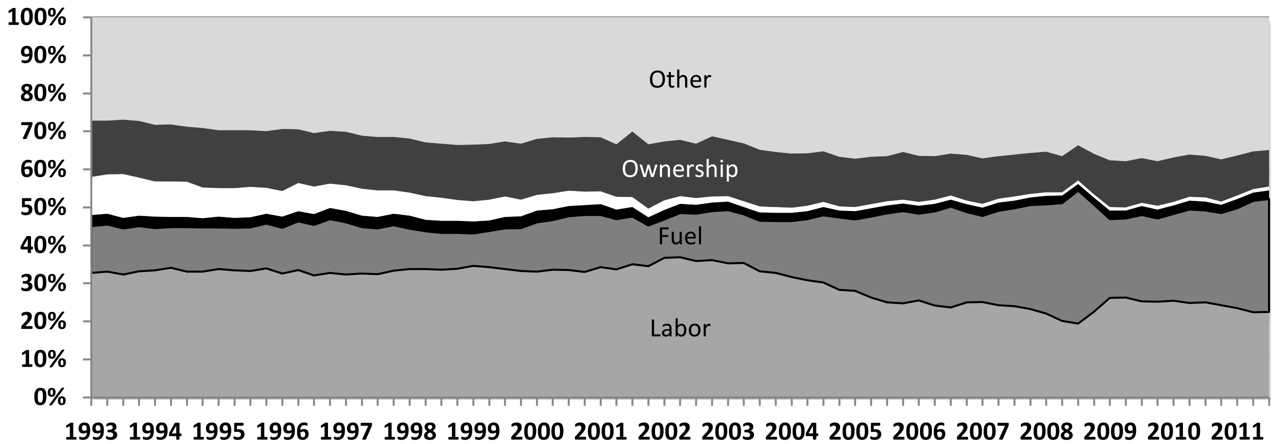
Figure 2-16 Fuel Cost per Available Seat Mile, 1993-2011



Source: U.S. DOT, Form 41

Fuel, as a percentage of costs, climbed from 10.2 percent in early 2002 to 29.7 percent in the third quarter of 2011. Historically throughout the 1990s, fuel accounted for only 11.0 to 12.0 percent of overall operating costs. As shown in Figure 2-17, fuel cost represents the largest airline cost component today, surpassing even labor. Labor represented the second largest component of operating costs at 22.5 percent in the third quarter of 2011, down significantly from 36.7 percent of overall costs in 2002. Aircraft ownership represents only 9.6 percent of current costs (down from approximately 15 percent in 2002) and has now been surpassed by the rising fuel costs.

Figure 2-17 U.S. Airlines Operating Costs, 1993-2011

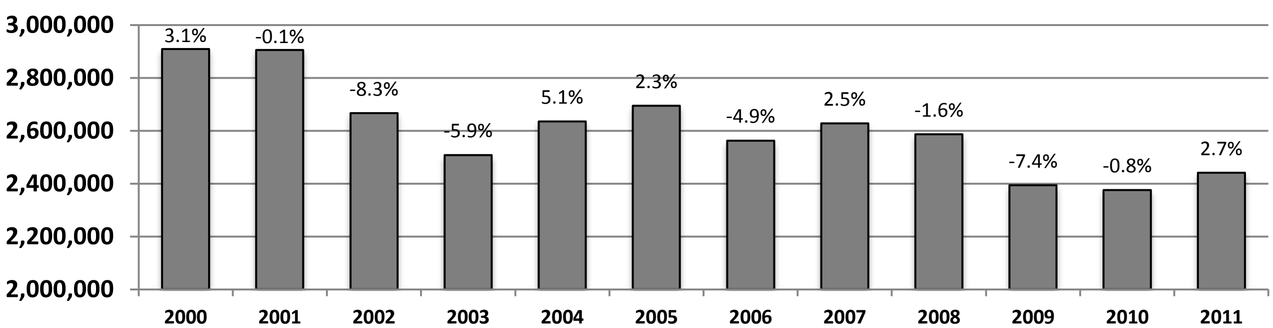


Source: U.S. DOT, Form 41

Capacity Discipline

Immediately after the events of September 11, 2001, airlines responded to weakened air travel demand and escalating operating costs by significantly curtailing capacity. While the airlines began to add back capacity in 2004, total capacity remained below the pre-September 11, 2001 levels in 2007. In 2009, a spike in fuel prices resulted in a steep increase in airline operating costs and sharp capacity cuts implemented by airlines. Though jet fuel prices fell again by the end of 2008, passenger demand continued to decline due to the ongoing economic recession. Carriers cut capacity in advance of declining demand. Seat capacity reductions slowed in 2010 as carriers responded to more favorable economic conditions. Capacity in 2011 has yet to recover to pre-2009 levels and remains about 17 percent below scheduled capacity at the beginning of the decade (July 2000) as shown in Figure 2-18.

Figure 2-18 U.S. Domestic Seats and Annual Change, 2000-2011

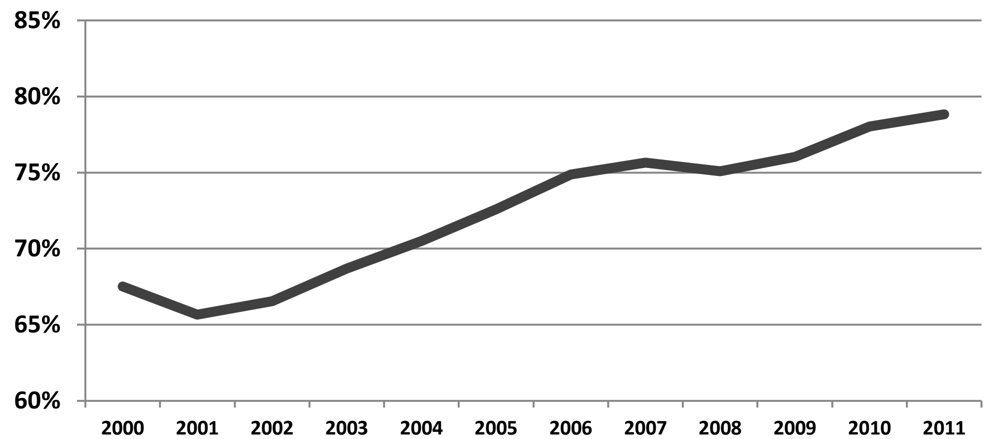


Source: Official Airline Guide (July 2000 – July 2011)

While airline service declines moderated in 2011, carriers are continuing to carefully monitor and control capacity. In the face of high fuel prices and slow economic recovery, the emphasis has shifted from seizing market share to careful management of supply-and-demand on routes. Carriers remained conservative on capacity expansion in 2011, continuing to cut service at smaller airports and in less profitable markets. Carriers are expected to maintain capacity discipline in the near-term, emphasizing cautious capacity growth and the use of right-sized aircraft to serve markets.

The drastic capacity cuts in 2009 and the current tight capacity control have pushed passenger load factors to an all-time high. Figure 2-19 shows the continuing upward trend in U.S. domestic airlines load factors over the past decade. Scheduled domestic load factors were at 68 percent in 2000. The dip in 2001 occurred as passenger traffic declined faster than airlines could reduce capacity due to the impacts of September 11, 2001. From that point forward, load factors rose steadily to approximately 79 percent in 2011. Continued rising load factors reflect reduced capacity and better revenue management on the part of the airlines.

Figure 2-19 U.S. Scheduled Passenger Operations Domestic Load Factors, 2000-2011



Source: U.S. DOT, T100

Aircraft Trends

Between 2001 and 2007, many airlines transferred a number of marginal jet routes to their regional carrier partners in order to cut costs. RJs replaced mainline jets on routes that mainline carriers could not operate profitably from Logan Airport. Trends at Logan Airport mirrored the national trend, with a rise in the number of regional operations.

However, beginning with the fuel spike in 2008, airlines began to cut back on the use of smaller 50-seat RJs. The recent trend has been the retirement of RJs and other less fuel efficient aircraft. The year 2011 saw a continued decline in the air carrier fleets of 37- to 50-seat RJs that were widely used in the first half of the decade as feed aircraft for network carriers. Carriers like Delta Air Lines, United Airlines/Continental Airlines, and American Airlines are expected to ground, scrap or sell hundreds of these small RJs in coming years. In the face of volatile fuel prices, airlines continued to move towards larger, more fuel efficient aircraft. Over the next decade, legacy carriers will continue to upgrade their fleets with new, fuel efficient aircraft, eliminating somewhat the fuel efficiency edge enjoyed by LCCs.

Airline Consolidation

The events of September 11, 2001 and the challenging operating environment resulting from high fuel prices, and the recent economic recession resulted in a number of airline bankruptcies over the past decade. Legacy carriers were forced to file for Chapter 11 protection and seek reorganization to lower costs. Between 2002 and 2005, US Airways, United Airlines, Northwest Airlines, and Delta Air Lines all filed for Chapter 11 protection. In 2011, American Airlines also filed for Chapter 11 protection. Other carriers such as ATA Airlines, Skybus Airlines, and Aloha Airlines discontinued passenger operations permanently.

The trend of industry consolidation through mergers and acquisitions has gained even more momentum in recent years. Delta Air Lines successfully acquired Northwest Airlines in 2008, becoming the world's largest carrier at that time. In 2011, Southwest Airlines' acquisition of fellow LCC AirTran Airways was approved, allowing Southwest Airlines to gain a strategically important market presence in Atlanta, GA. Other airline acquisitions and mergers are expected as airlines seek to reduce costs and increase their competitiveness in an increasingly challenging environment.

At Logan Airport, the merger of Delta Air Lines and Northwest Airlines resulted in substantial scheduled seat capacity reductions in 2010 as the consolidated carrier improved network efficiencies. Since that time, capacity has been added back to the market, and Delta Air Lines operations at the Airport saw a modest increase in 2011. The merged United Airlines and Continental Airlines kept operations flat at Logan Airport in 2011. Should the airline industry consolidate further, Logan Airport has a relatively low risk of losing passenger traffic, beyond some inevitable short-term disruptions, because of the underlying strengths of the Boston market. Logan Airport serves a market with a large local origin and destination (O&D) passenger base, above average income levels, a travel intensive economic base, and attractiveness as a destination market. In addition to these market fundamentals, JetBlue Airways has built a strong presence at Logan Airport and its growth over the past two years has offset any negative effects of recent airline consolidations.

Aviation Activity Forecasts for 2030

This section presents Massport's updated long-range planning forecasts for Logan Airport, as required by the Secretary of Environmental Affairs in the Certificate on the Logan Airport *2010 Environmental Data Report (2010 EDR)*. The methodology for the forecasts presented in this section is provided in Appendix E, *Activity Levels, Logan Airport Activity Forecast Methodology and Assumptions.* The forecasts are also compared to the previous planning forecasts that were presented in the *2004 ESPR*.

In 2011, Massport updated its long-range planning forecasts for Logan Airport, Worcester Regional Airport, and Hanscom Field to reflect the current status of the airline industry as well as emerging trends that are expected to influence aviation activities in the future. The base year for the forecasts was 2010 and the forecast years were 2015, 2020, and 2030. Three forecast scenarios were developed for Logan Airport: Low, Moderate and High. The strategic planning forecasts for Logan Airport included projections of passengers (domestic and international), cargo and aircraft operations (scheduled passenger, all-cargo, charter, and GA). The Moderate forecast scenario is viewed as the most likely forecast of future activity levels at Logan Airport and is used in this *2011 ESPR* to analyze future airport conditions and environmental impacts.

Updated Logan Airport Planning Forecast

Global and local economic and market conditions that have a bearing on aviation activity levels at Logan Airport continually evolve, requiring Massport to periodically reassess and update the planning forecasts. Since the *2004 ESPR*, there have been several developments that have affected aviation globally and within the New England region with implications for activity levels at Logan Airport. These include the following:

- A rapid increase in LCC services at Logan Airport following the entry of JetBlue Airways in 2004;
- Steep increases in fuel prices as the price of crude oil climbed more than doubled from an average of $42 per barrel in 2004 to $95 in 2011 (after reaching a record high of $145 in July 2008);
- An unprecedented global financial crisis and economic recession in 2008 to 2009 and a sluggish economic recovery;

- A shift in airline business models with increased focus on cost containment and profitability resulting in significant service reductions at smaller secondary airports;
- The retirement of large numbers of small RJ aircraft (50 or fewer seats) due to unfavorable operating economics in a high fuel price environment;
- Introduction of the Boeing 787 Dreamliner aircraft opening up new long-haul service markets for Logan Airport; and
- Airline industry consolidation leading to additional service rationalization.

Passengers

The region's economic growth is the primary driver of future air passenger growth at Logan Airport. The airport serves the seventh largest metropolitan area in the nation. Residents of the Boston metropolitan area have above average incomes and a high propensity for personal and business-related airline travel. Since no airline maintains a connecting hub operation at the Airport, Logan Airport is principally an O&D airport. Future passenger levels are therefore largely determined by underlying market demand and are not dependent on airline connecting passengers that transfer from one flight to another. The price of airline travel, which is inversely related to passenger growth, is another factor that affects passenger demand over the long-range. Real increases in the price of travel airline (i.e., adjusted for inflation) tend to moderate growth in airport passenger levels. Conversely, price reductions may lead to passenger growth as lower prices entice more people to travel. In the current and foreseeable future operating climate, the price of airline travel is strongly linked to fuel prices.

Historically, changes in air service levels and airfares at the closest regional airports, T.F. Green and Manchester Airports, have also had an impact on traffic levels at Logan Airport. From 1995 to 2002, Logan Airport's share of regional passengers began declining when Southwest Airlines introduced new nonstop services and lower airfares into the T.F. Green and Manchester markets, in 1996 and 1998, respectively. Traffic at Logan Airport grew more slowly than air traffic at the regional airports, and Logan Airport's share of the combined three airport market declined from 89 percent in 1995 to 72 percent in 2002. During this period, Logan Airport had very limited services from LCCs and a distinct fare disadvantage in many markets compared to T.F. Green and Manchester, coupled with the Central Artery/Tunnel project, which hampered Logan Airport's accessibility for many passengers in the region. However, the major portions of Central Artery/Tunnel project were completed in 2004 vastly improving access to the Airport, and LCC services grew rapidly at Logan Airport after the entry of JetBlue Airways in 2004. Following the increase in fuel prices and the 2008/2009 economic recession, airlines began sharply curtailing services at smaller secondary airports, including T.F. Green and Manchester Airports. As a result Logan Airport's passenger share climbed from a low of 72 percent to 81 percent in 2011. Over the forecast period, Logan Airport's percent share of the combined passengers at the three airports is assumed to increase slightly over the short-term to approximately 84 percent and then remain stable over the remainder of the forecast period.

The underlying forecast assumptions for long-range economic growth and changes in fuel prices and airline fares are summarized in Table 2-7. Total personal income for Massachusetts is assumed to increase at an average annual rate of 2.1 percent (excluding the effects of inflation) through 2030. The price of crude oil, the chief raw input for jet fuel, is forecast to increase to $123 per barrel in 2030, which in turn is assumed to increase the price of airline travel (measured in terms of airline yield, or ticket revenue per passenger mile flown) by 0.5 percent per year (excluding the effects of inflation).

Table 2-7 Major Forecast Assumptions	
Category	**Average Annual Change (2010-2030)**
MA Personal Income[1]	2.1%
Airline Yields[2]	0.5%
Category	**2030**
Price of Oil per Barrel (in 2009 dollars)	$123

Notes:
1 Adjusted for inflation
2 Excluding inflation.

The 2030 passenger forecast for Logan Airport is shown in Table 2-8. The Airport's total enplaning and deplaning passengers are forecast to increase by 1.7 percent annually reaching 39.8 million in 2030. Domestic passengers are forecast to grow by 1.4 percent per year, while international passengers are forecast to grow at a faster pace of 3.5 percent per year. Although international passenger traffic is forecast to grow more rapidly, domestic passengers are projected to represent 81 percent of Logan Airport's forecast passengers in 2030.

By 2030, Massport anticipates that Logan Airport will accommodate 7.6 million international passengers. Europe, one of Logan Airport's most mature international market segments, is forecast to grow at 2.9 percent per year. Passenger travel to and from Canada, another mature market, is forecast to remain relatively flat over the forecast period. Above average annual growth of 6.1 percent is forecast for the Caribbean market. More than a half million passengers are forecast for Asia and Latin America as a result of projected new non-stop services to destinations in these regions.

GA passenger traffic, which declined sharply during the 2008 to 2009 recession, and began a robust recovery in 2011, is forecast to remain relatively stable over the forecast period at approximately 108,000 passengers per year.

Table 2-8 Actual and Forecast Logan Airport Passengers, 2011 and 2030

Category	2011 Actual	2030 Forecast	Average Annual Growth (2011-2030)
Domestic	24,831,068	32,137,828	1.4%
Europe/Middle East	2,939,226	5,087,299	2.9%
Canada	573,660	568,805	0.0%
Caribbean/Bermuda	447,650	1,390,216	6.1%
Asia/Pacific	0	409,877	-
Central/South America	1,918	129,769	24.8%
Subtotal International	3,962,454	7,585,965	3.5%
GA	114,416	107,678	(0.3%)
Total	**28,907,938**	**39,831,471**	**1.7%**

Source: Massport
Notes: Totals may not add up due to rounding.
Numbers in parenthesis () indicate negative number.

Cargo

Cargo shipments handled at Logan Airport consist of heavy freight and express/small packages. The domestic market accounts for three-quarters of the cargo shipments at Logan Airport. Domestic cargo at Logan Airport is forecast to increase at approximately the same rate as the local economy. Approximately 83 percent of the domestic cargo at Logan Airport is carried by all-cargo airlines, primarily FedEx and UPS. Over the forecast period, the share of Logan Airport's cargo that is carried in all-cargo aircraft is assumed to increase to 86 percent in 2030, consistent with the FAA's assumption that all-cargo airlines will increase their share of the national domestic cargo market over the next 20 years. International cargo, which accounts for 24 percent of Logan's cargo shipments, is primarily carried in the belly compartments of international passenger aircraft and is a key contributor to the profitability of long-haul international passenger services. Future growth in international cargo is assumed to increase in proportion to the growth in international wide-body aircraft capacity at Logan.

As shown in Table 2-9, the total volume of cargo at Logan Airport is forecast to increase by 2.6 percent per year from 529 million pounds in 2011 to 867 million pounds in 2030. International cargo, which is predominantly carried in the belly compartments of passenger aircraft, is forecast to grow the fastest at 3.2 percent per year. Expected growth in international cargo is directly related to growth in wide-body belly capacity resulting from new long-haul international passenger services. The Express/All-Cargo segment, which is dominated by FedEx and UPS, is projected to increase by 2.6 percent a year. This segment of the cargo market is directly related to the local and national economies and is expected to increase at a slightly faster rate than the region's economic growth. Domestic belly cargo, the smallest segment of Logan Airport's cargo market, is forecast to increase by just 1.6 percent per year.

Table 2-9 Actual and Forecast Logan Airport Cargo (in pounds), 2011 and 2030

	2011 Actual	2030 Forecast	Average Annual Growth (2011-2030)
Domestic Belly	63,411,658	85,886,483	1.6%
International Belly	124,703,017	228,401,997	3.2%
Express All-Cargo	336,915,040	547,678,023	2.6%
Other All-Cargo	4,183,068	4,914,100	0.9%
Total	**529,212,783**	**866,880,603**	**2.6%**

Source: Massport
Notes: Totals may not add up due to rounding.
1 Includes regional jets with 100 or more seats.

Aircraft Operations and Fleet Mix

In 2011, Logan accommodated 28.9 million passengers, approximately 4 percent more passengers than in 2000, but with 119,000 fewer aircraft operations. The decline in aircraft operations over the last decade resulted from sharp reductions in the number of small aircraft flights (i.e., turboprops with 19 to 40 seats and RJs with 50 or fewer seats), increasing load factors, and fewer GA flights. These factors, however, are not expected to continue over the forecast period. Future declines in small aircraft flights (50 or fewer seats) will not be as significant, airline consolidation and high fuel prices will encourage the use of larger aircraft; load factors are high and cannot increase much further; and GA has rebounded from the steep declines stemming from the 2008 to 2009 economic recession.

Average load factor and aircraft size assumptions are summarized in Table 2-10. The average load factor for North America, the dominant market segment at Logan, is assumed to increase slightly from 77 percent in 2011 to 79 percent in 2030. Similarly, average aircraft size for North America is assumed to increase from 104 to 105 seats over the forecast period.

Table 2-10 Average Load Factor and Average Aircraft Size, 2011 and 2030

	Average Load Factors		Average Seats per Operation	
Region	2011	2030	2011	2030
North America	77%	79%	104	105
Europe	78%	82%	252	269
Asia	0%	80%	-	223
Latin America	-	79%	-	154

Aircraft operations are forecast to increase over the planning period at a slightly slower rate than passenger traffic, growing by 1.3 percent per year, as shown in Table 2-11. By 2030, Logan Airport is forecast to accommodate 474,734 annual aircraft operations. Passenger airline operations are expected to account for nearly 93 percent of total aircraft operations at Logan Airport in 2030.

The projected fleet mix for Logan Airport reflects a continuation of airline industry fleet trends, which include movement into larger capacity jet aircraft, a reduction in small RJ aircraft and increases in larger RJs and turboprops, which have more favorable operating costs in a high fuel price environment. At Logan Airport, the passenger airline aircraft fleet mix is expected to shift towards larger capacity jet aircraft. For example, large jets (100 or more seats)[13] accounted for 67 percent of passenger airline operations in 2011, and are forecast to represent 71 percent of 2030 operations. RJs (less than 100 seats) are expected to represent a declining share of the Logan Airport fleet mix falling from 18 percent of passenger airline operations on 2011 to 14 percent in 2030. The non-jet share will stay relatively stable at 14 percent in 2030 compared to 14.9 percent in 2011. Significant declines in the non-jet share are not expected over the forecast horizon primarily because airlines will continue to substitute larger turboprops (60 or more seats) for small RJs (50 or fewer seats) and Cape Air is expected to continue to operate over 30,000 annual flights with small piston-powered aircraft (9 seats). As a result of the expected shifts in the fleet mix and slightly higher passenger load factors, the average number of passengers per passenger airline operation is predicted to rise from 86 in 2011 to 90 in 2030.

Over the forecast period, all-cargo airlines are expected to acquire larger narrow-body and wide-body aircraft enabling them to carry more cargo per aircraft operation. As a result, Logan Airport's all-cargo aircraft operations are forecast to grow at 1.0 percent per year, more slowly than the projected 2.6 percent annual increase in Express All-Cargo volume.

After a robust recovery from steep declines in activity following the 2008/2009 Economic Recession, GA operations are forecast to remain relatively flat over the forecast period at approximately 27,000 operations.

13 Includes the Embraer-190 Regional Jet configured with 100 seats.

Table 2-11 Actual and Forecast Logan Airport Aircraft Operations, 2011 and 2030			
	2011 Actual	**2030 Forecast**	**Average Annual Growth (2011-2030)**
Passenger Service			
Jet (≥ 100 Seats)[1]	223,083	312,727	1.8%
Regional Jet (< 100 Seats)	61,704	65,480	0.3%
Non-Jet	49,700	61,982	1.2%
Subtotal	334,487	440,189	1.5%
All-Cargo	6,270	7,636	1.0%
GA	28,230	26,908	(0.3%)
Total	**368,987**	**474,734**	**1.3%**

Source: Massport
Notes: Totals may not add up due to rounding.
Numbers in parenthesis () indicate negative number.
1 Includes regional jets with 100 or more seats.

Comparison of Previous and Current ESPR Forecasts

Prior to this 2030 forecast, the last forecast prepared for Logan Airport was in 2003, and reported in the *2004 ESPR*. Conditions and trends have changed during that period, now reflected in the updated 2030 forecast. Table 2-12 compares the *2004 ESPR* planning forecast to the updated *2011 ESPR* planning forecast. The current forecast planning year is 2030, which is ten years beyond the 2020 planning horizon analyzed in the *2004 ESPR*. The current passenger forecast for 2030 is lower by 3 million passengers or 7 percent than the previous 2020 planning forecast of 42.8 million passengers. Similarly, the 2030 planning forecast for aircraft operations (475,000) is approximately 12 percent lower than the previous 2020 operations forecast (538,000). However, the number of aircraft operations projected to accommodate this higher passenger level (538,372 operations) is approximately 8 percent lower than the previous operations forecast (584,612 operations).

The current planning forecast has an average of 84 passengers per aircraft operation compared to 80 passengers per aircraft in the previous planning forecast. The increase in average passengers per flight is driven by an increase in average load factors and a shift in the fleet mix towards larger capacity aircraft. The 2030 aircraft fleet forecast has a higher percentage of large jet aircraft (100 seats or more) and reflects the next generation of narrow-body jets which have more seats than older models and growth in wide-body aircraft operations serving the long-haul international market. Similarly, the non-jet category reflects a shift to higher capacity turboprops, generally 60 to 70 seats compared to 30 seats for older models. In addition, the 2030 planning forecast has 53,000 fewer RJs. The reduction in RJs is primarily in smaller 30 to 50 seat models.

There will be opportunities to update the 2030 forecast based on the most current trends and data available during the next ESPR cycle (approximately 5 years after this *2011 ESPR*), if necessary.

Table 2-12 Comparison of Prior and Current Logan Airport Planning Forecast, 2020 and 2030

Activity	Prior Forecast[1] 2020	Current Forecast[2] 2030	Absolute Difference	Percent Difference
Passengers	42,823,810	39,831,471	(2,992,339)	(7.0%)
Operations				
Jet (≥100 Seats)[1]	338,190	312,727	(25,463)	(7.5%)
Regional Jet (<100 Seats)	118,501	65,480	(53,021)	(44.7%)
Non-Jet	28,080	61,982	33,902	120.7%
All-Cargo	11,387	7,636	(3,751)	(32.9%)
GA	42,213	26,908	(15,305)	(36.3%)
Total	538,372	474,734	(63,638)	(11.8%)
Percent of Total Operations				
Jet (≥100 Seats)[3]	62.8%	65.9%	3.1	
Regional Jet (<100 Seats)	22.0%	13.8%	(8.2)	
Non-Jet	5.2%	13.1%	7.9	
All-Cargo	2.1%	1.6%	(0.5)	
GA	7.8%	5.7%	(2.1)	
Total	100.0%	100.0%		
Passengers per Operation	80	84	4	

Source: Massport
Notes: Numbers in parenthesis () indicate negative number.
1 *2004 Environmental Status and Planning Report (ESPR)*
2 Moderate forecast.
3 Includes passenger charter operations and regional jets with 100 or more seats.

3

Airport Planning

Introduction

This chapter describes the status of projects underway or completed at Logan Airport in 2011 and provides an update through the filing of this report. This *2011 Environmental Status and Planning Report (ESPR)* also provides an analysis of anticipated future conditions in 2030 based on the likely passenger activity levels, aircraft operations, and aircraft fleet mix in 2030. For further information on the development of the 2030 long-range forecast, refer to *Chapter 2, Activity Levels.* Consistent with the environmental analyses for 2030 conditions provided in this *2011 ESPR,* this chapter also outlines known plans for future projects and planning concepts that are under consideration by the Massachusetts Port Authority (Massport) or its tenants through 2030.

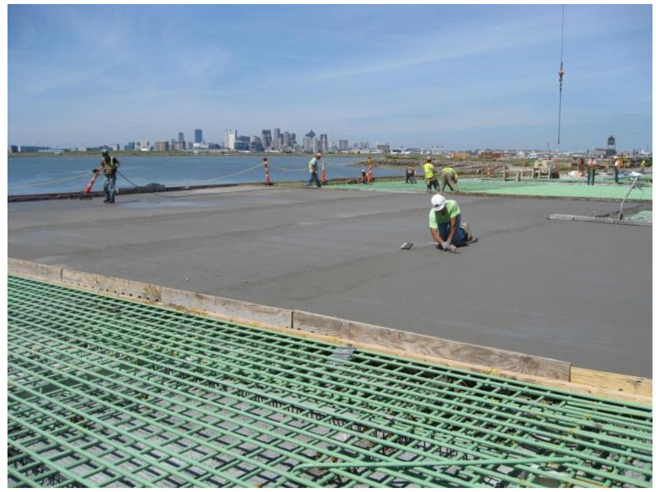
As discussed in *Chapter 1, Introduction/Executive Summary* of this *2011 ESPR*, any proposed project that triggers a threshold under the Massachusetts Environmental Policy Act (MEPA) or the National Environmental Policy Act (NEPA), will undergo the appropriate project-specific state and/or federal environmental review.

2011 Planning Highlights

Recent progress on individual projects at Logan Airport during 2011 and 2012 included:

- **Southwest Service Area (SWSA) Redevelopment Program (EEA 14137).** Massport completed the permitting for redeveloping the SWSA at Logan Airport, including a new consolidated rental car facility (ConRAC). Consolidation of the rental car operations and their shuttle buses into a single coordinated shuttle bus fleet operation will result in customer service improvements, stormwater system enhancements, reduced vehicle miles traveled (VMT), and the associated reductions in air emissions. ConRAC construction began in July 2010, starting with various enabling phases of construction, and will be completed in 2014.
- **Logan Runway Safety Area (RSA) Improvements Project at Runway Ends 33L and 22R (EEA 14442).** The safety improvements are required to enhance the RSAs, to the extent feasible, to be consistent with the Federal Aviation Administration's (FAA) current airport design criteria for RSAs and to enhance rescue access in the event of an emergency. As an older airport, Logan Airport was constructed before many of the current safety standards were developed and several of the runways currently end at the water's edge.

The RSAs enhancements that are currently under construction are safety improvements and do not extend runways; nor do they have any effect on normal runway operations, runway capacity or types of aircraft that can use the runways. Construction of the Runway 33L RSA improvements commenced in June 2011 and was completed ahead of schedule in November 2012. The Runway 22R RSA improvements are planned to be completed by the end of 2015. The status of mitigation for the RSA projects is provided in *Chapter 9, Mitigation Tracking*. As of this filing, mitigation efforts associated with Runway 33L safety improvements are underway.



Runway 33L Safety Improvements under Construction. Source: VHB.

- **Logan Runway 33L Light Pier Replacement Project (EEA 14442).** In January 2012, Massport submitted a Notice of Project Change (NPC) to the RSA Project (noted above) to include full replacement of the Runway 33L Light Pier, including all sections not already replaced by the Runway 33L RSA Project. All local, state and federal permits were secured in 2012 and the replacement was completed in November 2012 coinciding with the completion of the Runway 33L RSA project. As part of this project, the Runway 33L Instrument Landing System (ILS) approach was upgraded from CAT I to CAT III. FAA approved and published the aRea NAVigation (RNAV) procedure on March 7, 2013.

- **Green Bus Depot (EEA 14629).** Design of a bus maintenance facility for Massport's clean fuel fleet buses in the North Service Area (NSA) began in 2009. The Green Bus Depot will help to minimize bus traffic on local streets by serving as a central location for bus maintenance on Airport property rather than traveling for service at the off-site bus maintenance location in Chelsea. The Green Bus Depot is used to maintain the expanded clean fuel shuttle bus fleet that replaced Logan Airport's compressed natural gas (CNG) bus fleet and will maintain the rental car company diesel shuttle buses when the ConRAC opens. Construction was completed in September 2012 and the facility is now in operation.

- **East Boston-Chelsea Bypass Project (EEA 14661).** The Bypass is a limited access roadway between Logan Airport and the new Chelsea Street Bridge. The Bypass roadway is designed to improve commercial vehicle access to the Airport, as well as reduce congestion on local East Boston streets in the vicinity of Day Square, Eagle Square, and the Neptune Road corridor by directing airport-related commercial traffic to the new Bypass roadway. Construction was substantially completed in November 2012 and the roadway is open to Airport-related commercial service. The road was named the "Martin A. Coughlin" Bypass Road for the late Martin A. Coughlin, an East Boston resident. The project includes the use of high efficiency light-emitting diode (LED) lighting and incorporates bio-swales for stormwater retention and drainage.

- **Logan Airport Economy Parking Garage Project.** Construction of the Economy Parking Garage began in the summer of 2010 and was completed and fully opened to the public in early 2011. Sustainable features installed as part of this project included: solar panel "trees" on the garage roof, energy-efficient lighting, and trellis plantings with vines on the public edge of the garage façade.

- **North Service Area (NSA) Roadway Corridor Project.** The NSA Roadway Corridor extends approximately from the State Police building up to and including Neptune Road. This corridor improvement project is intended to unify the existing roadway with new landscape and urban design elements along this highly visible roadway corridor, providing an important public edge along the

corridor. Massport has installed a WindWheel Sculpture by William Wainwright on a parcel southwest of Neptune Road. Construction of the NSA Roadway Corridor Project began in 2010 and was completed in the spring of 2012.

- **Greenway Connector Project.** The Greenway Connector is a pedestrian/bicycle path connecting the Bremen Street Park path to the City of Boston pedestrian/bicycle path that begins at the Greenway Overlook and continues to Constitution Beach. When completed, the Greenway and the City of Boston Link will provide a continuous pedestrian/bicycle path from Piers Park to Constitution Beach. Construction of the Greenway Connector is planned to begin in the spring of 2013.
- **Hangar Upgrade Projects.** Architectural designs commenced in December 2010 for two hangar upgrades in the North Cargo Area (NCA) and are scheduled for completion in 2013. The renovated JetBlue Airways hangar opened in 2012.
- **Renovations and Improvements at Terminal B.** This project includes renovations to Terminal B, Pier A. By modifying and expanding existing facilities to meet airlines' needs and providing a connection between Piers A and B, the project improves and simplifies the passenger traveling experience. With initial renovations beginning in June 2012, the project is expected to be completed by 2014.
- **Terminal B Garage Improvement Project.** Terminal B Garage repair and rehabilitation was completed in March 2012. In addition to overall upgrades, sustainable features were also installed including 32 solar panel trees (200 kilowatt (kW)) on the top floor, high efficiency LED lighting throughout the garage, and two rainwater harvesting collection tanks to store and later recycle stormwater.
- **Landside Ground Access Operating Improvements.** The ConRAC, Green Bus Depot, East Boston-Chelsea Bypass Road, and the Economy Parking Garage are expected to yield substantial environmental benefits, particularly in the areas of ground access efficiencies and associated air quality emissions reductions on-Airport and in East Boston, as documented below.
  - The ConRAC project will reduce Airport VMT as well as improve roadway and intersection operations through three factors: 1) the consolidation of the rental car shuttle bus fleet and some Massport shuttle buses into a unified shuttle route system resulting in the elimination of eight rental car bus fleets (a net total of 66 buses would be eliminated); 2) intersection and roadway infrastructure improvements including signal coordination and dedicated ramp connections; and 3) creation of a Ground Transportation Operations Center (GTOC) enabling efficient planning and operation of Airport-wide transit activities.
  - The recently constructed Green Bus Depot (2012) serves as Logan Airport's on-Airport maintenance facility for Massport's new clean-fuel bus fleet. By shifting the bus maintenance operations out of the community, Massport is reducing bus traffic in East Boston and Chelsea.
  - The recently constructed East Boston/Chelsea Bypass (2012) is expected to reduce commercial traffic through East Boston by providing a direct link from Logan Airport's NSA to the Chelsea Street Bridge for Airport-related commercial vehicle trips.
  - The Economy Parking Garage simplifies and reduces traffic and transit VMT by consolidating multiple overflow parking lots throughout the Airport into a single location served by a single shuttle route. Overall traffic circulating throughout the Airport will likely decrease resulting in significant operational and environmental benefits.
  - The new bus fleet, comprising 18 CNG buses and 32 clean diesel/electric buses, will ultimately replace the entire fleet of diesel rental car shuttle buses once the ConRAC is operational in 2014.

As these facilities come on-line, future Environmental Data Report (EDR) and ESPR filings will report on the effects of more efficient operations and the predicted environmental benefits. Table 3-1 provides a summary of

the status of each project and planning concept, as of December 31, 2012. Descriptions are provided in subsequent sections of this chapter.

Table 3-1 Logan Airport Short- and Long-Term Development Initiatives

	Status as of 2012	Completion: Short Term	Completion: Long Term
Terminal Area Projects/ Planning Concepts			
Terminal E, Phase 1 and Phase 2	C		
Terminal E, Future Phase (West Concourse)	D		✈
Massport Satellite FIS Facility Project	H		
Terminal B Renovations	U	✈	
Terminal B Walkway Extension	H		
Terminal B Garage Repair and Rehabilitation	C	✈	
Service Area Projects/ Planning Concepts			
Relocated CNG Station in the NCA	E		✈
Consolidated Maintenance Facilities in the NCA	C		
Replacement Cargo Facilities in the NCA	E		✈
Replacement American Airlines Hangar in the NCA	H		✈
Replacement Hangar Facilities in the NCA	H		✈
New/Replacement GSE Consolidated Facility in the NCA	E		✈
Green Bus Depot in the NSA	C		
Flight Kitchen Consolidation in the NSA	C		
SWSA Program (Consolidated Car Rental Facility)	U	✈	
Ground Transportation Operations Center	U	✈	
NSA Roadway Corridor Project	C		

	Status as of 2012	Completion: Short Term	Completion: Long Term
Airport Parking Projects/ Planning Concepts			
NSA Economy Parking Consolidation	X		
Logan Airport Economy Parking Project in the NCA	C		
Airside Area Projects/ Planning Concepts			
Runways 22R and 33L Runway Safety Area Improvements	C (RW 33L) U (RW 22R)	✈	
Logan Airside Improvements Planning Project			
Runway 14-32 Construction	C		
Taxiway D Extension and Realignment	C		
Taxiway N Realignment	E	✈	
Centerfield Taxiway	C		
Shift Runway 15L/33R 200 feet to the East	E	✈	
Governors Island Aircraft Parking	H		✈
Buffer Projects/ Open Space			
SWSA Buffer	C (Phase 1) U (Phase 2)	✈	
NSA Buffer	D	✈	
Greenway Connector	D	✈	
Navy Fuel Pier	C		
Bremen Street Park	C		
Airport-Wide Projects/ Planning Concepts			
Logan Airport Wayfinding System	U[1]		
East Boston-Chelsea Bypass	C		

Notes: Anticipated completion dates and status as of December 31, 2011 as denoted by ✈.
Short term projects are anticipated to be completed by 2015 and long term projects are anticipated to be completed by 2030.
Details of each project or planning concept are provided in the sections that follow.

C – Completed prior to or during 2012.
D – Project in design, or awaiting funding
E – Planning concepts undergoing evaluation and/or feasibility analysis
H – Project or planning concept on hold
R – Project undergoing MEPA, NEPA/Federal Aviation Administration (FAA), or other review
U – Project under construction
X – Project cancelled
1 – Design has been completed. At this time, the project is not funded; all Wayfinding Improvements are being achieved on a project by project basis.

FIS – Federal Inspection Services
CNG – Compressed Natural Gas
NCA – North Cargo Area
GSE – Ground Support Equipment
NSA – North Service Area
SWSA – Southwest Service Area

Terminal Area Projects/Planning Concepts

The terminal area accommodates most of the passenger functions at Logan Airport including the passenger terminals, terminal area roadways, central parking facilities, and the Hilton Hotel. Table 3-2 presents information on the status of each ongoing terminal area project. In addition, both Massport and its tenants are proposing projects or exploring planning concepts to modernize and carry out future improvements to the existing terminal facilities. These planning concepts are also detailed in Table 3-2. The location of the ongoing terminal area projects and the planning concepts are shown on Figure 3-1.

Figure 3-1 Location of Projects/Planning Concepts in the Terminal Area

Source: Massport
Note: See Table 3-2 for a description of the numbered projects
1 International Gateway Project
2 Massport Satellite FIS Facility Improvements Project
3 Renovations and Improvements at Terminal B
4 Terminal B Garage Repairs

Table 3-2 Description and Status of Projects/Planning Concepts in the Terminal Area (December 31, 2011 through 2030)

Description	Status
Massport Projects/Planning Concepts	
1. International Gateway Project (Terminal E) The project expands and upgrades Terminal E to provide better service to international passengers. This project is being constructed in phases:	
Phase 1 – A weather-protected airside bus portico linking the ground floor with the second floor to accommodate passengers arriving from remotely parked aircraft.	Completed in 2004.
Phase 2 – Expanded Federal Inspection Services (FIS) Facility, and improved meeter/greeter lobby and the ticketing area to maximize passenger convenience and reduce processing times. Includes accommodation for bicycles.	Completed in 2007. Bike racks added at Terminal E in the summer of 2012
Future Phase – Construction of a new West Concourse, adding three new wide body aircraft gates.	Initial work on the Future Phase (new West Concourse) was completed as part of an airport-wide in-line baggage screening project in 2004. The remainder of the future phase is included in Massport's long-term capital plan and is anticipated to be in place by 2030.
2. Massport Satellite FIS Facility Improvements Project To accommodate more efficiently the potential growth of the international market, Massport proposed to construct a new satellite FIS Facility at the southeast end of Terminal B, Pier A.	This project is no longer being considered in this form.
3. Renovations and Improvements at Terminals B The airline industry continues to react to financial and other operating will pressures. This has led to a number of consolidations and realignments within the airlines. To address these changes and the continuing need for airlines to relocate with new partners, Massport has initiated analysis of terminal changes to better accommodate these ongoing airline partnership changes and facilitate broader flexibility in terminal utilization. This includes renovation of existing spaces, connecting of the Terminal B Piers, construction of some new spaces and reconfiguration of 8 aircraft gates to better facilitate passenger processing.	Construction of the Terminal B renovations and improvements commenced in 2012 and are planned for completion in 2014. Approximately 79,000 square feet of existing space will be renovated and approximately 84,000 square feet of new space will be added. Eight existing aircraft loading gates will be relocated.
Tenant Projects/Planning Concepts	
4. Terminal B Garage Repairs Structural repairs and garage lighting upgrades. Installed solar panels on garage roof.	This project includes routine maintenance as well as significant structural rehabilitation of the Terminal B Garage. The multi-year construction project is complete. While there were temporary reductions in garage capacity for construction, the project will not provide any additional parking capacity. The installed solar panels trees (200 kilowatts (kW)) on the garage roof and new light-emitting diode (LED) lighting have already begun to reduce energy consumption and improve air quality. Two 1,000 gallon rainwater collection tanks to recycle stormwater were set to provide water for maintenance and street sweeper use throughout Airport properties. Further details on energy savings are described in *Chapter 1, Introduction/Executive Summary.*

Note: See Figure 3-1 for the location of terminal area projects/planning concepts.

Service Area Projects/Planning Concepts

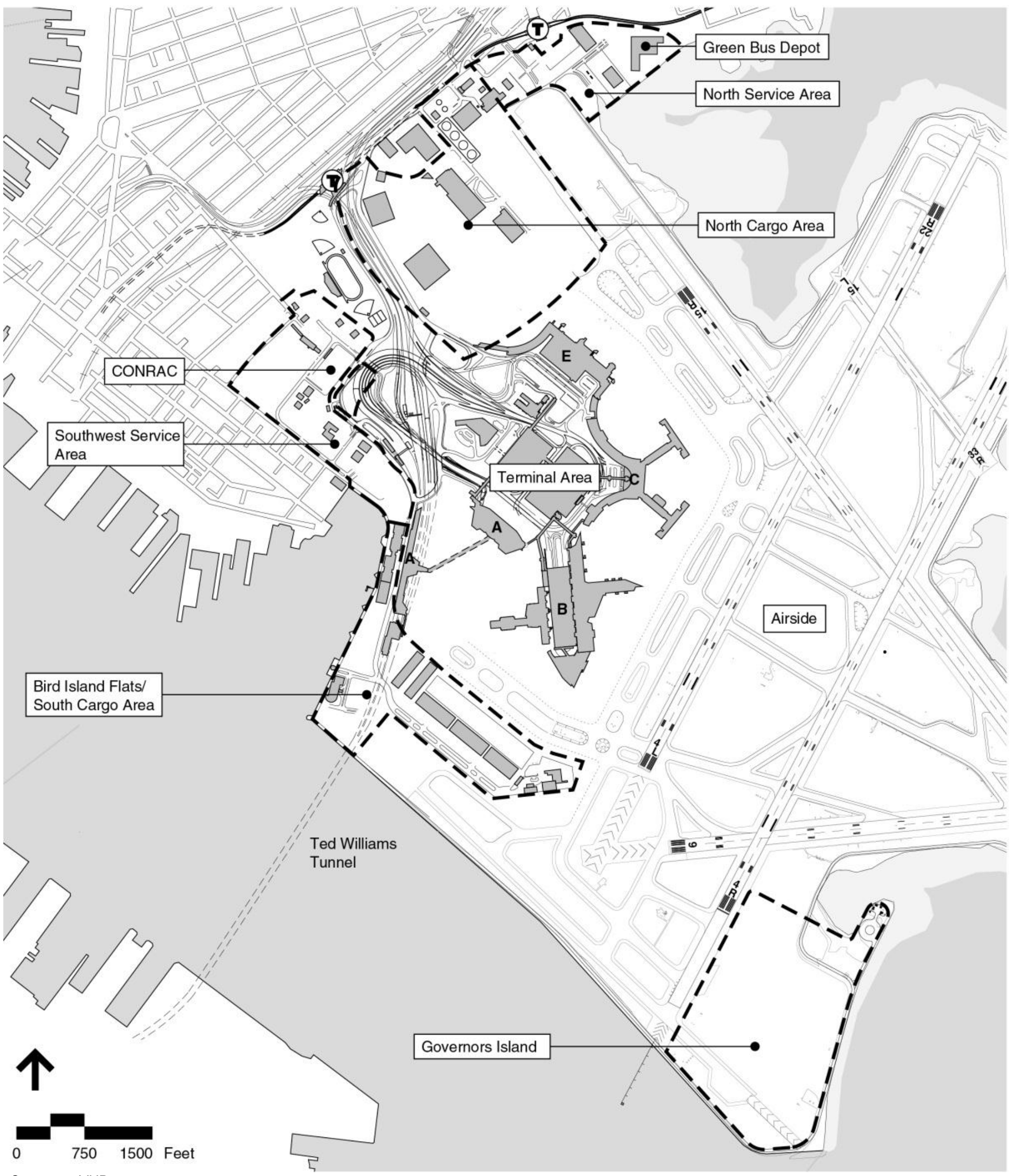
Logan Airport's service areas contain airline support businesses and operations. Land uses in the service areas continually evolve in response to changing airline business, customer, and tenant needs, as well public works projects. Massport continues to explore more efficient ways of using the limited land resources in the service areas. The five service areas at Logan Airport are shown in Figure 3-2 and are described below:

- **North Cargo Area (NCA)** is located in Logan Airport's northwest corner. It is bounded by the main Logan Airport outbound roadway to the south, Route 1A to the west, the Jet Fuel Storage Facility to the north, and the airside apron area to the east. The NCA, which is adjacent to Logan Airport's airside area, is the Airport's primary airline support area. It accommodates air cargo and essential airline support businesses including hangars, ground service equipment (GSE) maintenance, and aircraft parking. The NCA is the most appropriate location for businesses and operations that require contiguous airside access and for businesses such as cargo that require adjacent landside as well as airside access. The NCA is the likely location for future hangar expansion either between or in the vicinity of the American Airlines and Delta Air Lines hangars, for replacement cargo buildings and for aircraft parking to accommodate changes in aircraft fleet over time. In the interim, portions of the NCA will continue to be used for economy parking.
- **North Service Area (NSA)** is located north of the NCA near the Massachusetts Bay Transportation Authority's (MBTA) Wood Island Station and Runway 15R-33L. The NSA includes two flight kitchens, weather and navigation equipment, the temporary bus/limousine pool, an airport edge buffer and the new Green Bus Depot. Massport will also construct a section of the East Boston Greenway Connector running parallel to the MBTA Blue Line corridor in this section of the Airport.
- **Southwest Service Area (SWSA)** is located south of Logan Airport's main access roadway and is bounded on the east by Harborside Drive. Because of its proximity to the terminals and the regional highway system, the SWSA functions as Logan Airport's primary ground transportation hub and includes the taxi and bus/limousine pools. The entire SWSA is being redeveloped to accommodate the new ConRAC facility and associated activities. As an interim measure during ConRAC construction, the bus and limousine pools have been temporarily relocated to the NSA. The taxi pool has been temporarily relocated to Lot B, which is on Harborside Drive between the Logan Office Center Garage and the Hyatt Hotel. The former Gate Gourmet flight kitchen was relocated to a vacant flight kitchen facility in the NSA in 2012. The old Gate Gourmet building was demolished in 2012 to accommodate the new SWSA access roadway. The SWSA redevelopment project is scheduled for completion in 2014.
- **Bird Island Flats/South Cargo Area (BIF/SCA)** is located south and southeast of the Logan Airport's SWSA, and is generally bounded on the south by Boston Harbor and on the east and north by Logan Airport's airside area. The BIF/SCA is two service areas connected by Harborside Drive. The BIF portion has landside access via Harborside Drive and water access via the system of water taxis that shuttle passengers between downtown Boston, the South Shore, and Logan Airport. BIF development includes the Hyatt Hotel and Conference Center, the Logan Office Center and adjoining garage, an employee parking lot (Lot B), the Water Shuttle Dock, the Logan Airport Rescue and Fire Fighting Facility Marine Dock, and the Harborwalk that is a publicly accessible promenade along the harbor's edge. The SCA portion is Logan Airport's primary cargo area. It provides landside access and secured airside access. It also accommodates domestic and some international cargo operations and temporary relocation of the taxi pool during SWSA redevelopment. During construction of the ConRAC project, the Lot B surface employee lot is being used as the interim taxi pool. Once the taxi pool is relocated to its permanent new home along Porter Street in the SWSA, Lot B will be returned to an employee parking lot.
- **Governors Island (GI)** is located at Logan Airport's southern tip and is bounded by Runway 14-32 and Boston Harbor to the east and south, by Runway 4R to the west, and Runway 9 to the north. GI has

functioned as a storage site for the Central Artery/Tunnel (CA/T) Project and for construction stockpiles. The area also contains an Aircraft Rescue and Fire Fighting Facility training area, parking for snow removal equipment, a biocell remediation area, and FAA aircraft navigation equipment. The area has been considered as a future location of remain overnight (RON) aircraft parking.

Table 3-3 presents information on the status of each ongoing project and planning concept in the service areas. Both Massport and Logan Airport tenants are proposing projects or exploring planning concepts to modernize and carry out future improvements to the service areas. These planning concepts are also detailed in Table 3-3. The location of the ongoing service area projects and planning concepts that may potentially be constructed in the future are shown on Figure 3-3.

Figure 3-2 Logan Airport Service Areas



Source: VHB.

Figure 3-3 Location of Projects/Planning Concepts in the Service Areas

Source: Massport
Note: See Table 3-3 for a description of the numbered projects
1 Southwest Service Area Redevelopment Program, Consolidated Rental Car Facility, and Ground Transportation Operations Center
2 Relocated Compressed Natural Gas Station in the North Cargo Area (NCA)
3 Replacement Cargo Facilities in the NCA
4 North Service Area (NSA) Roadway Corridor Project
5 Replacement American Airlines Hangar in the NCA
6 Replacement Hangar Facilities in the NCA
7 Green Bus Depot in the NSA
8 Flight Kitchen Consolidation in the NSA
9 New/Replacement Ground Support (GSE) Consolidated Facility in the NCA

Table 3-3 Description and Status of Projects/Planning Concepts in the Service Areas (December 31, 2011 through 2030)	
Description	**Status**
Massport Projects/Planning Concepts	
1. Southwest Service Area (SWSA) Redevelopment Program The SWSA Redevelopment Program consolidates on-Airport and most off-Airport rental car operations and facilities into one integrated facility (ConRAC) to better serve tenants and the traveling public, to reduce ground transportation and air quality impacts on-airport and in the surrounding neighborhoods, and to reduce associated off-airport impacts and accommodates a portion of off-Airport rental car operations. Redevelopment of the SWSA is needed because the existing SWSA and rental car facilities were inefficient and not adequate to meet Logan Airport's or the rental car companies' future needs. The SWSA Redevelopment Program is replacing and upgrading existing ground transportation uses within the SWSA. The redevelopment includes a consolidated car rental facility with a four-level garage to accommodate rental car retail operations and storage; support facilities for the car rental operations; a new clean-fuel unified shuttle bus system; a relocated and reconfigured taxi pool; bus and limousine pool; and roadway improvements, pedestrian and bicycle facilities, and site landscaping. It also includes a customer service center and four quick turn-around maintenance and service facilities. Leadership in Energy and Environmental Design® (LEED) Silver certification is being pursued for the facility. ConRAC construction was preceded by numerous enabling activities that reorganized the SWSA through multiple sub-phases allowing for enough of the site to be cleared for staging and construction. Some of these enabling projects include reorganization of rental car operations within the SWSA. Others include temporary relocation of ground transportation operations for a limited time period, including the taxi pool to Lot B, the Cell Phone Lot to an existing open parking lot across from the Logan Airport gas station, and the bus and limousine pool to the North Service Area (NSA). The project also included the demolition of the existing flight kitchen to allow the extension of Hotel Drive. Phase 2 of the SWSA Buffer (EEA #14137) (see Table 3-5) is being integrated with the proposed SWSA Redevelopment Program.	A Final Environmental Impact Report/Environmental Assessment (EIR/EA) was prepared in accordance with the Secretary of Energy and Environmental Affairs' Certificate on the Notice of Project Change (NPC). The Final EIR/EA was filed on March 1, 2010. An extended comment period closed on May 24, 2010. The Secretary's Certificate finding that the Final EIR adequately and properly complies with Massachusetts Environmental Policy Act (MEPA) was issued on May 28, 2010. The project is now under construction and completion is anticipated in late 2013/2014. Several of the enabling projects have been completed or are underway, including temporary relocation of the taxi pool to Lot B, relocation of the cell phone lot from Lot B to the intersection of Hotel Drive and North Service Road, and relocation of the bus and limousine pool to the NSA. These enabling projects were necessary to allow for mobilization and construction within the SWSA. In addition, the first quick-turnaround rental car maintenance and service facility is now under construction.

Table 3-3 Description and Status of Projects/Planning Concepts in the Service Areas (December 31, 2011 through 2030) (Continued)	
Description	**Status**
Massport Projects/Planning Concepts	
1. Southwest Service Area (SWSA) Redevelopment Program (Continued) **Ground Transportation Operations Center (GTOC)** The new GTOC within the ConRAC facility will function as the hub for management of ground transportation at the Airport. GTOC staff will assume direct responsibility for: ▪ Shuttle bus management and reporting via computer-aided dispatch (CAD) and automatic vehicle location (AVL) technology ▪ Real-time bus and transit information collection and dissemination to airport users ▪ Coordination with internal and external agencies related to ground transportation GTOC staff will also provide indirect support for: ▪ Long-term ground transportation planning efforts ▪ Taxi and limousine pool management ▪ Parking management ▪ Traffic management on Airport roadways The GTOC will include a video wall to graphically display information from a variety of sources, including: vehicle location and status information from the CAD/AVL system, curbside camera feeds from the Consolidated Camera Surveillance System (CCSS), flight arrival and departure information from Flight Information Display System (FIDS), the status of curbside Dynamic Message Signs (DMS), emergency alerts, and other information.	Construction of the GTOC was underway in 2012 as part of the ConRAC project and is planned to open with the full ConRAC in 2014.
2. Relocated Compressed Natural Gas (CNG) Station in the North Cargo Area (NCA) This would involve the relocation of Massport's existing CNG Station to accommodate the airside operations in the NCA.	Massport continues to examine several potential on-Airport parcels for relocation of the existing CNG station. Relocation is not expected to occur before 2015.
3. Replacement Cargo Facilities in the NCA Construction of new cargo facilities in the NCA would compensate for the loss of cargo facilities that resulted from the Central Artery/Tunnel (CA/T) Project, as well as for the projected growth in cargo demand.	The project remains under evaluation. If a decision is made to proceed with this project, construction would likely commence after 2015. Hangar upgrades for Buildings 8 and 9 are in the feasibility assessment stage.
4. North Service Area (NSA) Roadway Corridor Project The NSA Roadway Corridor Project coordinates the roadway and urban design vision for North Service Road and Frankfort Street with on-going design and construction efforts in the NSA. The project will coordinate with the NCA Logan Airport Economy Parking Garage, East Boston- Chelsea Bypass Project, the SWSA redevelopment enabling projects and the NSA Buffer Project to produce a unified utility, roadway, and landscape vision for the NSA roadway corridor between Prescott Street and Neptune Road.	The project was under construction and completed in 2012. The Greenway Connector pedestrian/bicycle path, which would provide a section of the connection between Bremen Street and Constitution Beach adjacent to the NSA, is described in Table 3-5.

Table 3-3 Description and Status of Projects/Planning Concepts in the Service Areas (December 31, 2011 through 2030) (Continued)	
Description	**Status**
Massport Projects/Planning Concepts	
5. Replacement American Airlines Hangar in the NCA This proposal would involve the renovation of portions of the American Airlines Hangar to keep it operational until demolition and reconstruction planning can be completed. Roof, mechanical systems, and restrooms are top priorities for renovation. Ultimately the existing 97,000-square foot American Airlines Hangar would be demolished and replaced with a new hangar that could accommodate Group V aircraft.	Planning and design for this proposal has been placed on hold indefinitely. If a decision is made to go ahead with this project, construction would not likely commence until after 2015.
6. Replacement Hangar Facilities in the NCA Construction of new hangar facilities in the NCA would be required to compensate for the loss of hangar facilities that resulted from the CA/T Project, as well as for the projected demand for hangar space.	Evaluation of this planning concept has been placed on hold. If planning resumes, construction would not likely commence until after 2015.
7. Green Bus Depot in the NSA The Green Bus Depot occupies a 7.7-acre site in the North Service Area. The new facility would service the new fleet of Massport clean-fuel shuttles buses including approximately 30 hybrid-electric buses and 20 CNG buses. The new maintenance facility will allow the bus fleet to remain on the airport instead of traveling to Chelsea where current maintenance facilities are located. Access to the facility would be from the existing Airport roadway system. LEED Silver certification is being pursued for the facility.	An expanded ENF was filed with MEPA in July 2010. No further MEPA review was required and construction commenced in 2011. Construction was completed in 2012.
Tenant Projects/Planning Concepts	
8. Flight Kitchen Consolidation in the NSA This project would consolidate existing on-Airport operations in the NSA.	Due to changes in the flight kitchen industry post-September 11, 2001, expansion of flight kitchen facilities is not anticipated. Initial consolidation of the flight kitchen functions occurred in 2005 with the consolidation of the LSG SkyChef facilities into one building in the NSA, leaving one adjacent flight kitchen facility vacant. The inactive flight kitchen was renovated and reactivated in early 2012 when Gate Gourmet relocated from the SWSA to the NSA.
9. New/Replacement Ground Support Equipment (GSE) Consolidated Facility in the NCA This planning concept would provide multi-tenant maintenance facilities for GSE.	In 2007, Signature Flight constructed a multi-tenant GSE facility as a component of its fixed-based operator facility and the proposed expansion of the GSE facility is under-going a feasibility analysis. If the conceptual planning for the proposal moves beyond feasibility screening, construction would not likely commence until after 2015.

Note: See Figure 3-3 for the location of service area projects/planning concepts.

Airside Area Projects/Planning Concepts

The airside area includes all Logan Airport land from the edge of the terminal buildings to the Logan Airport harbor boundary, incorporating the Logan Airport apron, runways, gates, and other airfield operating facilities. Airside improvements include upgrades and improvements to the airfield to enhance the operational efficiency and safety of Logan Airport. Table 3-4 describes the status of projects (shown on Figure 3-4) and planning concepts under consideration for Logan Airport's airside area as of March 1, 2013.

Figure 3-4 Location of Projects/Planning Concepts on the Airside

Source: Massport
Notes: See Table 3-4 for a description of numbered projects.
1 Runway 22R and 33L Runway Safety Area (RSA) Improvements
2 Logan Airside Improvements Planning Project
2a Demolition and relocation of Cargo Buildings 60 and 61
2b Construction of a new unidirectional 5,000 foot Runway 14-32
2c Construction of a Taxiway D straightening and realignment
2d Straightening and realignment of Taxiway N
2e Centerfield taxiway
2f Reduction in approach minimums on Runways 22L, 27, 15R, and 33L by FAA
3 Governors Island Aircraft Parking

Table 3-4 Description and Status of Projects/Planning Concepts on the Airside (December 31, 2011 through 2030)

Description	Status
1. Runway 22R and 33L Runway Safety Area (RSA) Improvements The FAA requires RSAs to accommodate aircraft overruns, undershoots, and veer-offs in emergency situations. Consistent with FAA requirements, Massport is continuously looking for opportunities to increase the margin of safety for all runways and where practicable providing FAA standard RSAs at all locations. At Logan Airport, the FAA standard RSA is typically 500 feet wide by 1,000 feet long at each runway end. Where this space is not available, the FAA has approved the use of Engineered Materials Arresting System (EMAS) for aircraft overrun protection. EMAS uses a system of collapsible concrete blocks that can stop an aircraft by exerting predictable forces on the landing gear while minimizing aircraft damage. In 2004, the FAA approved installation of a 190-foot section of EMAS at Runway 22R. The FAA also directed Massport to evaluate opportunities for additional safety enhancements at this location. Massport installed a 158-foot of EMAS at Runway 33L in 2006, in anticipation of full environmental review of additional improvements. A detailed alternatives analysis was conducted to evaluate options for safety enhancements at both runway-ends. As described in the 2009 Environmental Notification Form (ENF), 2010 Draft Environmental Assessment/Environmental Impact Report (EA/EIR), and 2011 Final EA/EIR, an Inclined Safety Area (ISA) similar to what was constructed at Runway-End 22L is proposed for Runway End 22R. A pile-supported deck with EMAS approximately 460 feet long by 300 feet wide is proposed for Runway End 33L.	Massport filed an ENF with MEPA on June 30, 2009 that described the proposed RSA enhancements at both runway ends. A Draft EA/EIR was filed on July 15, 2010. A Final EA/EIR was filed January 31, 2011 and the Secretary's Certificate was issued March 18, 2011. Remaining environmental permits were secured by May 2011 and construction of the 33L RSA was completed ahead of schedule in November 2012.Runway End 22R enhancements will be completed by the end of 2015.
Runway 33L Light Pier Replacement. The Runway 33L timber light pier was constructed in 1960 and extends to the south-east 2,400-feet from the runway end, predominantly over Boston Harbor. The Runway 33L RSA project is replacing the landward 500-feet of the light pier. During RSA construction, it was determined that replacement of the remaining 1,900-feet of the light pier should be replaced due to its advanced age and efficiencies of combining the construction with the RSA project in the summer of 2012 while the runway was already closed.	Massport filed a Notice of project Change (NPC) to the RSA project in January 2012. The Secretary's Certificate was issued March 9, 2012. All local, state and federal permits were secured for the additional work in June 2012 and the full replacement was completed in October 2012. As part of this project, the Runway 33L Instrument Landing System (ILS) approach was upgraded from CAT I to CAT III. FAA approved and published the aRea NAVigation (RNAV) procedure on March 7, 2013.

Table 3-4 Description and Status of Projects/Planning Concepts on the Airside (December 31, 2011 through 2030) (Continued)

Description	Status
2. Logan Airside Improvements Planning Project The project involves construction of a new unidirectional Runway 14-32, Centerfield Taxiway, extension of Taxiway D, realignment of Taxiway N, improvements to the southwest corner taxiway system, relocation of cargo buildings, and reduction in approach minimums on Runways 22L, 27, 15R, and 33L. These airfield improvements were to reduce current and projected levels of aircraft delay and enhance airfield safety at Logan Airport. The components of this project and status are presented below.	
a. Demolition and relocation of Cargo Buildings 60 and 61.	This component of the project was completed in 2006.
b. Construction of a new unidirectional 5,000-foot Runway 14-32.	Construction was completed in 2006 and Runway 14-32 became operational on November 23, 2006. The first full year of operation of Runway 14-32 was 2007.
c. Construction of a Taxiway D straightening and realignment, and southwest corner taxiway realignment and the installation of lighting, marking, signage, and drainage.	The southwest corner taxiway realignment component of the project was completed in 2007. The Taxiway D extension was fully constructed in 2009.
d. Straightening and realignment of Taxiway N.	This project component is anticipated to commence after 2015.
e. Construction of a 9,300-foot long Centerfield Taxiway located between and parallel to Runway 4L-22R and Runway 4R-22L.	As part of its Record of Decision (ROD) for the Airside Improvements Planning Project under NEPA, the FAA initially deferred its decision on Centerfield Taxiway (Taxiway M) pending an operational review to identify any other potential beneficial actions. The FAA directed the technical work on the operational review and conducted briefings with a citizen panel. The FAA divided the study into two phases. Phase 1 focused on current conditions and Taxiway N, and Phase 2 included operations with both Taxiway N and the Centerfield Taxiway. Both of these Phases were completed and the public comment period on the project ended in September of 2007. The FAA approved the Centerfield Taxiway in April, 2007. Construction of the Centerfield Taxiway began in the spring of 2008 and was completed in August of 2009. The Centerfield Taxiway is being used as intended by the EIS for taxiing for long-haul domestic and international flights using Runway 22L and to improve flow on the airfield and reduce taxiway congestion. Massport paved the taxiway with warm mix asphalt, which reduces energy consumption and has air quality benefits.
f. Reduction in approach minimums on Runways 22L, 27, 15R, and 33L by FAA.	Reduction in approach minimums on Runways 15R and 33L was approved in the Airside EIS/EIR. Implementation will be affected by realignment of the Instrument Landing System (ILS) localizer. Construction impacts of relocation of the ILS localizer were addressed as part of the proposed enhancements to the RSA at the end of Runway 33L (see above). The new Runway 33L RSA deck will be able to accommodate the future relocation of the localizer. Additional navigational upgrades were installed as part of the Runway 33L Light Pier Replacement Project in 2012. Runway 33L is expected to be operating as a Category III ILS in March 2013.

Table 3-4 Description and Status of Projects/Planning Concepts on the Airside (December 31, 2011 through 2030) (Continued)	
Description	**Status**
3. Governors Island Aircraft Parking Massport has considered providing additional aircraft parking at Governors Island for the following: Remain overnight (RON) aircraft; cargo aircraft; and international aircraft. RON aircraft are generally commercial passenger aircraft that fly into the airport at night and fly out in the morning. Airlines sometimes schedule and position more aircraft than there are gate positions, therefore remote aircraft parking positions are required. Remote aircraft parking is appropriate for cargo aircraft that generally arrive in the morning and remain on the ground until their late evening departure. Some international scheduled and charter aircraft that have long turnaround times should be parked remotely when there is a high demand for gates.	Preliminary concepts evaluated by Massport involve the development of 20 to 50 aircraft positions and ancillary uses. This project is on hold. If the concept is deemed feasible and planning continues, it is anticipated that construction would occur after 2015.

Note: See Figure 3-4 for the location of airside projects/planning concepts.

Airport Buffer Areas and Other Open Space

Massport has committed up to $15 million for the planning, construction, and maintenance of four airport edge buffer areas and two parks along Logan Airport's perimeter. Three buffers have been completed, including the Bayswater Buffer, Navy Fuel Pier Buffer, and SWSA Buffer Phase I. The SWSA Buffer Phase 2 is now under construction. These areas are located generally along the Logan Airport's perimeter boundary and are intended to provide attractive landscape buffers between airport operations and adjacent East Boston neighborhoods. The buffer design occurs in consultation with Logan Airport's neighbors and other interested parties in an open community planning process. To collaborate in East Boston open space planning, Massport also participates in meetings with other agencies including Massachusetts Department of Transportation (MassDOT), the City of Boston and the MBTA. Table 3-5 describes the status of ongoing buffer projects and other Massport greenspace projects under consideration as of March 1, 2013. Figure 3-5 shows the location of these buffer projects.

Figure 3-5 Location of Airport Buffer Projects/Open Space

Source:	Massport.
Note:	See Table 3-5 for a description of the numbered projects.
1	Southwest Service Area (SWSA) Buffer
2	North Service Area (NSA) Airport Edge Buffer (Neptune Road Buffer)
3	Navy Fuel Pier Buffer
4	Bayswater Embankment
5	Bremen Street Park
6	The Greenway Connector

Table 3-5 Description and Status of Airport Edge Buffer Projects/Open Space (December 31, 2011 through 2030)

Description	Status
1. Southwest Service Area (SWSA) Buffer Phase 1 of this project involves the construction of an approximately half-acre linear area with landscaping and lighting improvements along Maverick Street that will include evergreen and deciduous trees, ornamental shrubs, and groundcovers.	Phase I construction was completed in 2006.
Phase 2 of this project involves additional landscaping and solid barriers.	Phase 2 of the SWSA Buffer design has been integrated with the SWSA Redevelopment Program. Phase 2 consists of installing landscaping (i.e., densely planted or planted atop earth berms for enhanced separation) and solid barriers such as fences and walls. The project will enhance bicycle and pedestrian connectivity between Maverick Street and East Boston Memorial Park and Stadium with extensive landscaping including trees, shrubs, flowering perennials, and decorative fences. The Secretary's Certificate on the SWSA Redevelopment Project Final Environmental Impact Report (FEIR) was issued in May, 2010. Construction of the SWSA Phase 2 Buffer is anticipated to be completed in late 2013/2014.
2. North Service Area (NSA) Airport Edge Buffer (Neptune Road Buffer) The NSA Buffer involves landscape improvements along the airport edge. The NSA Buffer will involve significant landscape beautification and improved pedestrian/bicycle connections, primarily on the Massport parcel located at the intersection of Neptune Road and Vienna Street.	Massport selected a design consultant in May 2009 and began the community planning process in December 2010. Construction is anticipated to commence in 2013. In the interim, a series of landscape improvements along Logan Airport's north entrance are underway.
3. Navy Fuel Pier Buffer The Navy Fuel Pier Buffer project began with the Army Corps of Engineers' (ACOE) remediation of the former Navy Fuel Pier, which was completed in 2001. The project involved beautification of the property (0.7 acres) through landscape improvements and stabilization of the waterfront perimeter.	Final construction of the buffer was completed in 2007.
4. Bayswater Embankment This project involved creation of a landscaped buffer between Bayswater Street and Boston Harbor.	Construction of this airport edge buffer was completed in 2003.
5. Bremen Street Park The 18-acre Bremen Street Park was constructed by the Central Artery/Tunnel (CA/T) Project as East Boston's second largest neighborhood park. The park contains a variety of facilities, a direct pedestrian connection to Massachusetts Bay Transportation Authority's (MBTA) Blue Line Airport Station, and a half-mile segment of the three-mile East Boston Greenway. The park was built on land previously used as off-airport parking.	Final construction of the park was completed in 2008.
6. The Greenway Connector The one-half mile pedestrian/bicycle path connects the Bremen Street Park pedestrian/bicycle path to the City of Boston/DCR Greenway Connector to Constitution Beach. When completed there will be a continuous pedestrian/bicycle path from Piers Park to Constitution Beach that will connect Piers Park, Bremen Street Park, Stadium Park, and Constitution Beach.	Massport continued work with the City of Boston and community representatives and others in 2012 regarding the design and construction of the Greenway Connector between Bremen Street Park and an Overlook at Wood Island Marsh. The City of Boston will construct a pedestrian/bicycle path from the Overlook to Constitution Beach. The Greenway Connector construction documents were completed in 2012 and construction is scheduled to begin in the spring of 2013 and is anticipated to be completed in late 2013.

Note: See Figure 3-5 for the location of airport edge buffer projects/planning concepts.

Airport Parking Projects/Planning Concepts

The total number of employee and commercial parking spaces permitted at Logan Airport is limited by the Logan Airport Parking Freeze under the State Implementation Plan (SIP). Parking supply at Logan Airport has varied with respect to the specific locations and sizes of individual lots, the mix of parking spaces for air travelers and employee spaces, and the number of spaces in and out of service at any one time due to construction projects being undertaken at Logan Airport, while at all times remaining in compliance with the Logan Airport Parking Freeze. *Chapter 5, Ground Access to and from Logan Airport* contains additional information on the historic and existing supply of parking at Logan Airport. Table 3-6 describes current commercial parking projects at Logan Airport. The locations of parking projects are shown on Figure 3-6.

Figure 3-6 Location of Airport Parking Projects/Planning Concepts

Source: Massport.
Note: See Table 3-6 for a description and status of numbered projects.
1 Logan Airport Economy Parking Garage Project in the NCA (North Cargo Area)

Table 3-6 Description and Status of Airport Parking Projects/Planning Concepts (March 2011)	
Description	**Status**
1. Logan Airport Economy Parking Project in the NCA (North Cargo Area) This involved construction of an interim two-level deck above the existing surface economy parking lot on the Robie Parcel in the NCA. The two decks, above ground level parking, will facilitate consolidation of existing temporary parking at various on-airport locations to one location. The parking consolidation will result in significant customer service improvements, operational and environmental benefits including reduced vehicle miles traveled with associated air quality benefits.	On June 23, 2010, the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) issued an Advisory Opinion confirming that no MEPA review was required for this parking consolidation. Construction of all the relocated parking spaces was completed in early 2011. *Chapter 5, Ground Access to and from Logan Airport* describes how the parking consolidation will be managed in accordance with the Logan Parking Freeze. Bicycle racks were added in 2012.

Note: See Figure 3-6 for the location of airport parking projects/planning concepts.

Economy Parking Garage. Source: Massport.

Airport-wide Projects

Massport regularly plans and implements airport-wide projects/planning concepts such as those described in Table 3-7.

Table 3-7 Description and Status of Future Airport-wide Projects/Planning Concepts (December 31, 2011 through 2030)	
Description	**Status**
1. Logan Airport Wayfinding System This project provides a comprehensive wayfinding system for Logan Airport facilities including terminals, terminal curbside, parking garages, and approach roadways including airport wide signage analysis and planning, development or design guidelines and graphic standards, and a master implementation plan for future projects.	The main project was completed with improvements to the wayfinding system ongoing. This project currently has no funding and is being implemented in phases as part of other projects as feasible.
2. The East Boston-Chelsea Bypass (Dedicated Airport Access Road) (EEA# 14661) This bypass was planned as a new roadway connection between Logan Airport and the Chelsea Street Bridge following an abandoned rail corridor. The dedicated Bypass roadway is for airport access only and is for commercial vehicles only. The Bypass roadway will provide a means to remove airport traffic (trucks, cargo vehicles, parking shuttles, taxis, transit buses, etc.) from the local road system. The Bypass road is expected to reduce congestion on local East Boston streets in the vicinity of Day Square, Eagle Square, and the Neptune Road corridor. The Bypass may also be used by MBTA transit vehicles.	An Environmental Notification Form (ENF) was filed in October 2010, and project construction began in 2011.The roadway was completed in November 2012 and the Bypass is now open**.** The road was named the "Martin A. Coughlin" Bypass Road for the late Martin A. Coughlin, a neighborhood activist who lobbied for a commercial road to reduce traffic congestion in Day Square.

Logan Airport in 2030

In 2030, Logan Airport is envisioned to be an efficient airport handling more aircraft and passengers within a modernized terminal system and ground access network. While the footprint of Logan Airport is constrained by its location with Boston Harbor on three sides and the East Boston community on the other, Massport will continue to use the available land in an effective and environmentally sound manner. Key features include consolidated parking, a streamlined bus and shuttle system, attractive landscaped buffers, leading edge stormwater management infrastructure, and internal improvements to the terminals, which make better use of existing space, enhance intra-terminal connectivity, and improve the security processing facilities. Massport does not anticipate any major changes to the airfield between 2011 and 2030 other than minor upgrades for safety and operational efficiency and routine maintenance (the Runway 33L RSA improvements were completed in November 2012 and the Runway 22R improvements will be completed by 2015).

Although no major roadway changes are currently planned, Massport will be advancing a series of curb infrastructure improvements that will improve operations, high-occupancy vehicle (HOV) access, curb utilization, customer service, safety, and the environment as well as reduce curb dwell times for Logan Airport beginning in 2013. With more passengers expected to be traveling to and from the Airport in 2030, the appropriate mix of HOV/shared-ride/transit services and parking strategies will be necessary to maintain acceptable levels of service on the airport roadways and terminal curbsides. Recent Massport ground access investments, such as the ConRAC, Unified Shuttle Bus Fleet, Green Bus Depot, Economy Parking consolidation, and the East Boston-Chelsea Bypass Road, were key steps in establishing conditions under which Logan Airport can accommodate some of the future passenger levels while minimizing traffic impacts on- and off-Airport.

Additional short- and long-term initiatives will continue to be explored as operating conditions evolve. For example, in 2013, Massport will evaluate further the long-term feasibility of the Silver Line pilot program, which offers free-fare boardings at Logan Airport. In addition, Massport plans to test new pricing and schedule initiatives for Logan Express in order to generate incentives for use of the popular scheduled bus service. Furthermore, Massport is exploring a proposal for formalizing a regional shared-ride van service agreement for Logan Airport. Longer-term initiatives will be evaluated in the context of an agency-wide planning effort, which is expected to be underway in 2013.

As further detailed in *Chapter 5, Ground Access to and from Logan Airport*, by the year 2030 Logan Airport could expect a peak parking demand that would exceed the current limit of commercial parking spaces placed by the Logan Airport Parking Freeze and the available on-airport spaces. Under constrained parking conditions, much of this travel demand to the Airport will be met through modes other than on-airport parking. The key challenge for Massport is to discourage growth in curbside drop-off/pick-up activity by private vehicles or taxicabs, since those often result in the most vehicle trips, greatest curb demand, and highest emissions. This will be done by encouraging growth in sustainable transportation modes, including public transit, HOVs, and shared-ride services. Massport's longer-range ground access strategy will carefully consider both the parking constraint and new HOV initiatives.

In 2030, Massport will remain committed to sustainability. Massport will continue to use and refine its Energy Master Plan, incorporate sustainable and renewable energy features on key infrastructure projects whenever possible, and use the Sustainable Design Guidelines and Standards to guide the construction and renovation of new and existing buildings. Through these measures, Massport will continue to reap environmental benefits in the areas of improved energy efficiency and renewable energy generation, materials reuse and recycling, enhanced stormwater management, and water conservation.

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4 Regional Transportation

Introduction

This chapter places Logan Airport in the context of the New England region's transportation system and reports on the status of the region's airports in 2011. Massachusetts Port Authority's (Massport's) ongoing efforts to support an efficient regional air and surface transportation networks are discussed. Massport has developed updated passenger activity and aircraft operations forecasts for the airports which it manages, namely Logan Airport, Hanscom Field, and Worcester Regional Airport. Massport is considering a long-range planning horizon out to 2030. The planning forecasts for Hanscom Field are addressed under a separate report, the *Hanscom Field ESPR*. This chapter focuses on the current year and provides the status of long-range regional transportation planning efforts in the region which are relevant to Massport's three airports as well as the regional transportation network. This chapter specifically describes:

- Passenger and aircraft operations activity levels at the regional airports in 2011 including: Bradley International Airport (CT); T.F. Green Airport (RI); Manchester-Boston Regional Airport (NH); Portland International Jetport (ME); Burlington International Airport (VT); Bangor International Airport (ME); Tweed-New Haven Airport (CT); Portsmouth International Airport at Pease (NH); Worcester Regional Airport, Massachusetts (MA); and Hanscom Field (MA).
- Changes in airline service levels and other factors that have contributed to trends in regional airport activity.
- The status of current improvement plans and projects at the regional airports.
- Massport's initiatives and joint efforts with other transportation agencies to improve the efficiency of the New England regional transportation system.
- Regional long-range transportation planning efforts.

Key Findings and Status Update

Key findings and status updates for New England regional airports and the regional transportation system in 2011 and for future long-range planning efforts include the following:

- The total number of air passengers utilizing New England's commercial service airports, including Logan Airport, increased from 43.1 million in 2010 to 44.7 million annual air passengers. This represents an

annual increase of 3.8 percent, which exceeds the overall average increase of 1.7 percent in the U.S. passenger market in 2011.[1] In comparison, the total number of air passengers utilizing New England's commercial service airports was 46.7 million in 2000 and 45.6 million in 2004. The decline in passenger traffic at the regional airports reflects the challenging operating environment facing U.S. airlines since the global economic downturn that began in 2008 and is consistent with the national trend at secondary and tertiary airports.

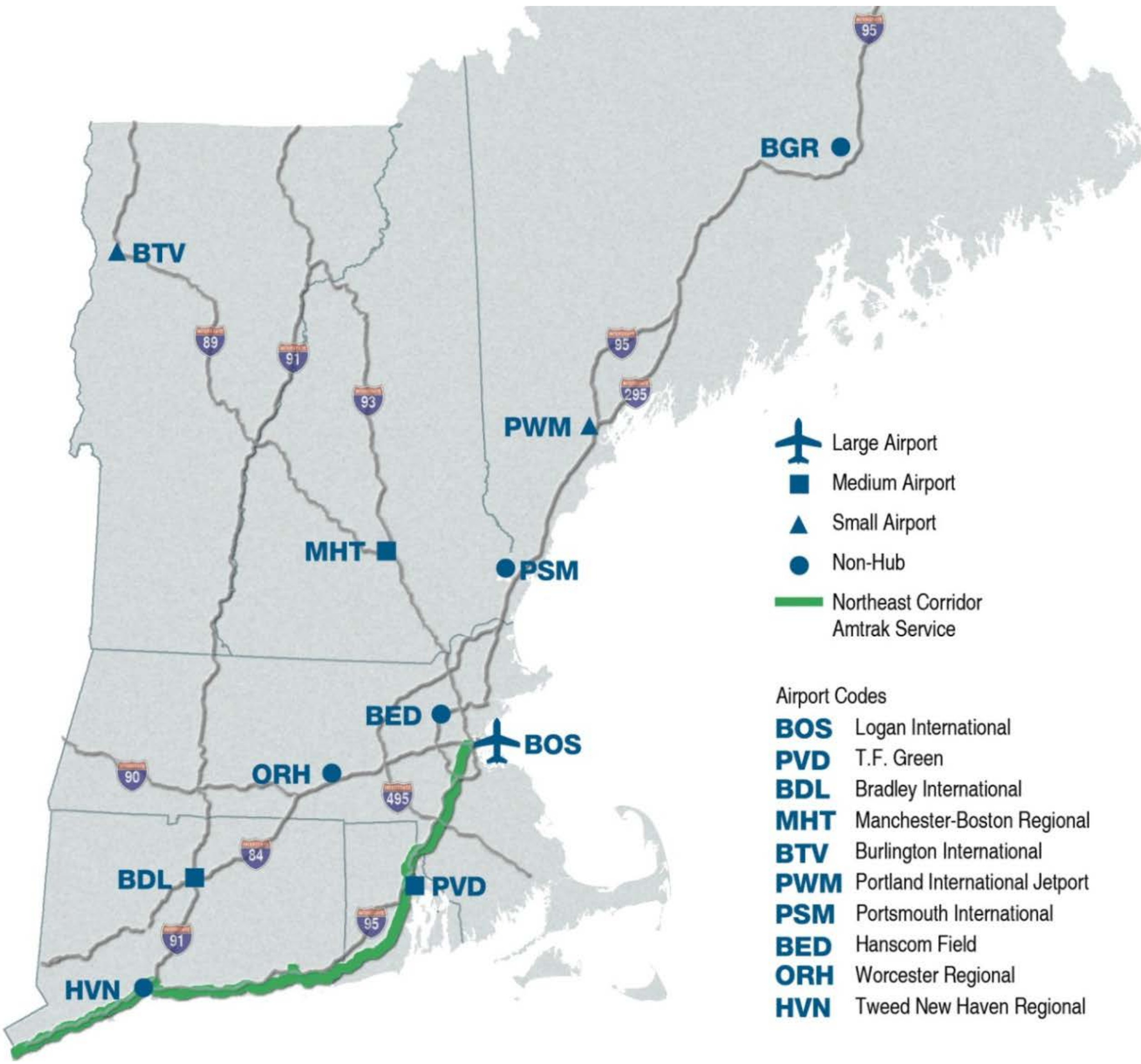
- The challenging airline operating environment has continued to affect smaller communities disproportionately. Within the region, Logan Airport passenger traffic grew considerably faster than air passenger levels at the other regional airports. Of the 44.7 million air passengers using New England's commercial service airports in 2011, 64.7 percent of air passengers (28.9 million) used Logan Airport compared to a low of 55.5 percent (22.7 million) in 2002. Despite the recent increases in Logan Airport's regional share, it remains well below a high of 73 percent in 1985.[2] Passenger levels at the regional airports increased by 1.1 percent (0.2 million) in 2011, compared to an increase of 5.4 percent (1.5 million) at Logan Airport. This trend reflects a slow recovery at the regional airports following the recent service cuts by legacy air carriers and low-cost carriers (LCCs) in these smaller secondary markets. Growth at Logan Airport has been driven by the continued expansion of LCC service, in particular, JetBlue Airways.
- Aircraft operations in the New England region increased by 2.1 percent, from 1.07 million operations in 2010 to 1.09 million operations in 2011. Commercial airline operations remained largely flat, increasing by 0.8 percent (4,932 operations), while general aviation (GA) increased by 4.3 percent (17,827 operations) due primarily to a recovery in GA activity since the 2008/2009 economic recession. Military operations decreased by 1.4 percent (483 operations). While aircraft operations in the region increased slightly in 2011 compared to 2010, aircraft operations have declined significantly since 2000. Total regional aircraft operations fell by nearly one third, from 1.6 million in 2000 to 1.1 million in 2011.
- On July 1, 2011, the State of Connecticut established the Connecticut Airport Authority (CAA) with the goal of transforming Bradley International Airport and the state's five general aviation airports (Danielson, Groton/New London, Hartford Brainard, Waterbury-Oxford, and Windham airports) into economic drivers for the state.
- Massport continued to engage in metropolitan cooperative planning efforts including GreenDOT, the Healthy Transportation Compact,[3,4] and the Boston Metropolitan Planning Organization (Boston MPO).
- Massport is participating in the development of the Massachusetts Department of Transportation's (MassDOT) first statewide strategic multi-modal, long-range transportation plan known as *weMove Massachusetts*.[5] The goal of *weMove Massachusetts* is to build action-oriented policies based on stakeholder feedback to implement priorities for the present and future needs of the Massachusetts transportation system.
- Massport is cooperating with MassDOT's efforts to expand Boston's South Station to meet the current and future demand for rail mobility within Massachusetts and along the Northeast Corridor.
- MassDOT and the other New England state transportation agencies are collaborating with the Federal Aviation Administration (FAA) on the *New England Regional Airport System Plan – General Aviation* study to provide an understanding of general aviation airports, infrastructure and capital needs for the New England region.

1 Airports Council International, 2011 Worldwide Air Traffic Report.
2 Based on airport passenger statistics from 1985 to 2011.
3 Massachusetts Department of Transportation, www.eot.state.ma.us/default.asp?pgid=content/releases/pr060210_GreenDOT&sid=release, June 2, 2010.
4 Massachusetts Department of Transportation, www.massdot.state.ma.us/main/healthytransportationcompact.aspx.
5 Massachusetts Department of Transportation, Office of Transportation Planning. http://www.massdot.state.ma.us/wemove/ (Accessed November 2012).

New England Regional Airport System

As shown in Figure 4-1, the New England region is anchored by Logan Airport, serving a major international gateway and domestic origin-and-destination market, and a system of 10 commercial service, reliever and GA airports[6] (regional airports); together, these 11 airports accommodate nearly all of New England's air travel demand. The regional airports range in activity levels from the Bradley International Airport, which served 5.6 million commercial passengers in 2011, to Hanscom Field, which handled 6,500 charter passengers in 2011.

Figure 4-1 New England Regional Transportation System



6 The *New England Regional Airports Air Passenger Service Study* (FAA, 1995) defined the Bradley International, T.F. Green, Manchester, Portland International Jetport, Bangor, Burlington, Worcester Regional and Tweed-New Haven Airports as the region's principal commercial airports, other than Logan Airport, since all of these airports either supported or had previously supported commercial jet passenger services. Subsequently, in 1999, limited commercial passenger service was introduced at Hanscom Field and at Portsmouth International Airport, though neither airport has been able to sustain commercial airline services over the long-term. These 11 airports are included in the New England Regional Airport System Plan (NERASP) Study, which was published in 2006.

Massport owns and operates two of the regional airports, Hanscom Field and Worcester Regional Airport, which both play important roles in the regional transportation system, as described below.

- Hanscom Field (BED) is located in Bedford, MA, approximately 15 miles northwest of Logan Airport, and is New England's premier facility for business/corporate GA. Hanscom Field serves as a GA reliever airport for Logan Airport, accommodating a variety of GA operations. In 2011, there were approximately 163,000 aircraft operations at Hanscom Field, over five times the number of GA operations that occurred at Logan Airport. In addition to its role as a GA facility, Hanscom Field has also accommodated niche commercial airline services in the past. However, Hanscom Field lost scheduled commercial service at the beginning of 2008 when Boston-Maine Airways discontinued services to Trenton, NJ. Streamline Air, a public charter carrier, launched regularly scheduled flights at Hanscom Field in April 2011. Streamline provided scheduled charter flights on 30-seat turboprop aircraft between Hanscom Field and Trenton, but services were discontinued September 14, 2012.
- Worcester Regional Airport (ORH) is located in central Massachusetts, approximately 40 miles west of Logan Airport. Worcester Regional Airport is recognized as an important aviation resource that can accommodate both corporate/GA activity and commercial airline services. In 1995, Massport began collaborating with the City of Worcester, the Airport's then owner, to identify opportunities for increasing Worcester Airport's utilization in order to accommodate some of the regional demand that would otherwise use Logan Airport. Massport assumed operation of Worcester Regional Airport in 2000 and later acquired the Airport in June 2010. In 2011, aircraft operations at Worcester Airport totaled 46,700 operations, with GA accounting for 94 percent of aircraft activity. After losing commercial airline services in 2006 when Allegiant discontinued service, Worcester Regional Airport regained regularly scheduled charter service in 2008 with the entry of Direct Air. Direct Air served Worcester Regional Airport through 2011, flying to Myrtle Beach and other Florida destinations, but subsequently ceased all operations in March 2012. Massport is currently considering enhancing ORH's all-weather capability including upgrading the Runway 11 Instrument Landing Systems (ILS) from a Category I to a Category III system, and its associated taxiway infrastructure and navigation aids.

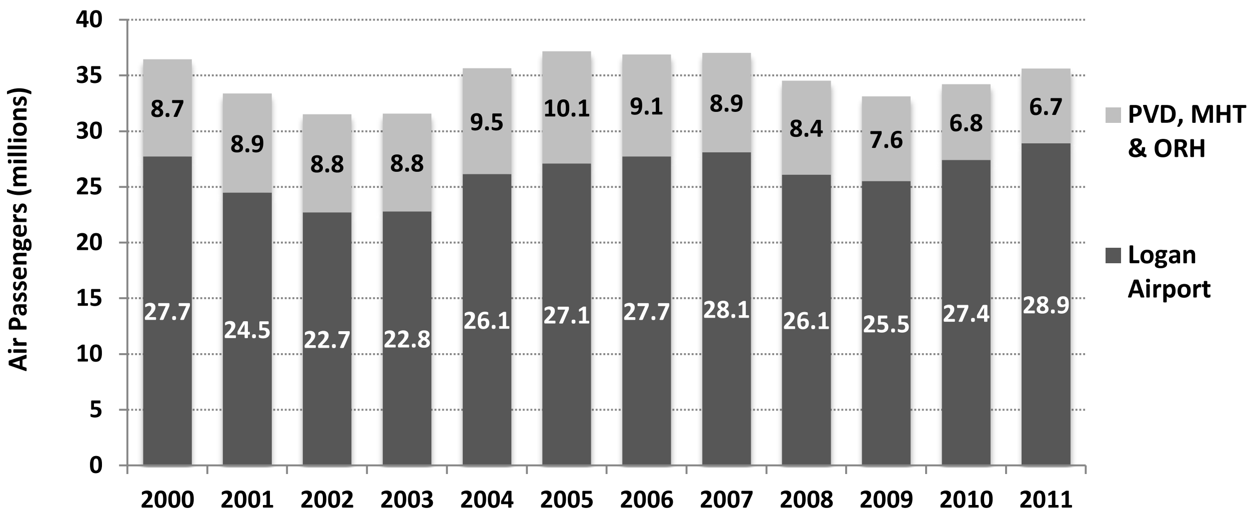
The regional airports that are closest to and have the greatest influence on passenger traffic and aircraft activity at Logan Airport are T.F. Green Airport in Warwick, RI and Manchester-Boston Regional Airport in Manchester, NH. These airports are in close proximity to Logan Airport and have overlapping market areas, providing convenient choices for some passengers in the Greater Boston Area and beyond. The New England Regional Airport System Plan (NERASP) Study, which was published in 2006, identified a high degree of cross-airport utilization within the Greater Boston airport system: Logan Airport, T.F. Green Airport, and Manchester-Boston Regional Airport. In effect, the three airports act as a system of airports, with significant numbers of passengers choosing the most convenient airport in terms of access, airfares, and available air services depending on their individual air travel needs.[7]

In the first half of the decade, the Central Artery/Tunnel construction project and high fares made Logan Airport less attractive for many air travelers in the Greater Boston area. T.F. Green Airport and Manchester-Boston Regional Airport were viewed as convenient alternatives to Logan Airport. Offering low-cost services on Southwest Airlines, these two airports captured an increasing share of the Greater Boston market. However, with the completion of major portions of the Central Artery/Tunnel project in 2004, as well as JetBlue Airway's entry and expansion at Logan Airport, the Airport has recaptured passengers from its core service area that were previously using the regional airports.

7 *New England Regional Airport System Plan,* Federal Aviation Administration, 2006.

Logan Airport is now well-positioned in terms of access, airfares, and available air services to meet the demands of the core Boston passenger market. Despite declines in airline services and passenger traffic, T.F. Green Airport and Manchester-Boston Regional Airport are also positioned to serve their own catchment areas. Even after the recent traffic declines, both airports accommodate considerably more passengers from their respective market areas than before the entry of Southwest Airline in the late 1990s. In 2011, T.F. Green, Manchester-Boston Regional, and Worcester Regional Airports served 18.8 percent (6.7 million) of the combined passengers (35.6 million) at the four Greater Boston market area airports, down from a high share of 28.0 percent (8.8 million) in 2002. The highest level of passengers accommodated by the three regional airports over the past 11 years was 10.1 million passengers in 2005. Figure 4-2 depicts the historical distribution of air passengers for these three regional airports and Logan Airport.

Figure 4-2 Passenger Activity Levels at Logan Airport and T.F. Green, Manchester-Boston Regional and Worcester Regional Airports, 2000-2011



Source: Massport and individual airport data reports.

In addition to Logan Airport and the regional airports discussed above, a third tier of airports serves isolated communities or provides niche commercial airline services in New England. These airports include: Hyannis Airport, Martha's Vineyard Airport, Nantucket Memorial Airport, New Bedford Regional Airport, and Provincetown Municipal Airport in MA; Augusta State Airport, Bar Harbor Airport, Rockland Airport, and Northern Maine Regional Airport in ME; Lebanon Municipal Airport in NH; Block Island State Airport and Westerly State Airport in RI; and Rutland Southern Vermont Regional Airport in VT. The third-tier airports support frequent commercial service to Logan Airport and, in some instances, T.F. Green Airport during the summer months. Most of these third-tier airports are not in close proximity to Logan Airport and are isolated due to geographic factors. Because of their remoteness and/or limited market areas, many of these airports are unlikely to attract passengers that now fly from Logan Airport. Instead, these airports are dependent on Logan Airport for connecting services.

Air Passenger Trends

The following section provides an overview of air passenger trends for the regional airports over the last decade.

Regional Airport Passengers

In 2011, New England's 11 commercial airports accommodated 44.7 million passengers. As shown in Table 4-1, total air passenger traffic at the New England airports increased by 3.8 percent, up from 43.1 million in the prior year. The growth in air passenger traffic in the region surpassed overall growth in the U.S. passenger market, which increased by 1.7 percent in 2011.[8]

The increase in the region's air passengers was driven by growth at Logan Airport, where passenger traffic grew by 1.5 million or 5.4 percent. Passenger traffic at the other regional airports grew slightly by 0.2 million or 1.1 percent in 2011. Consequently, the 11 regional airports' share of New England passengers decreased to 35.3 percent in 2011, compared to 36.3 percent in 2010 and 44.5 percent in 2002 (Figure 4-3). Despite the recent declines in regional airport passengers, the regional airports continue to accommodate a significant share of the region's passengers, up substantially from 31.3 percent in 1995 and 27.0 percent a decade earlier in 1985. The decline in passenger traffic at the regional airports reflects the challenging operating environment facing U.S. airlines and is consistent with the national trend at secondary and tertiary airports. The global economic downturn that began in 2008 resulted in a drop in passenger demand and widespread airline capacity reductions, particularly at the smaller regional airports. Airlines eliminated less profitable routes, cut frequencies in smaller markets, and reduced flying with small regional jets (RJs), which had become uneconomical to operate with sustained high fuel prices. While the majority of the service cuts were completed by 2010, airlines remained conservative with growth plans and did not increase overall capacity significantly at the regional airports in 2011.

8 Airports Council International, 2011 Worldwide Air Traffic Report.

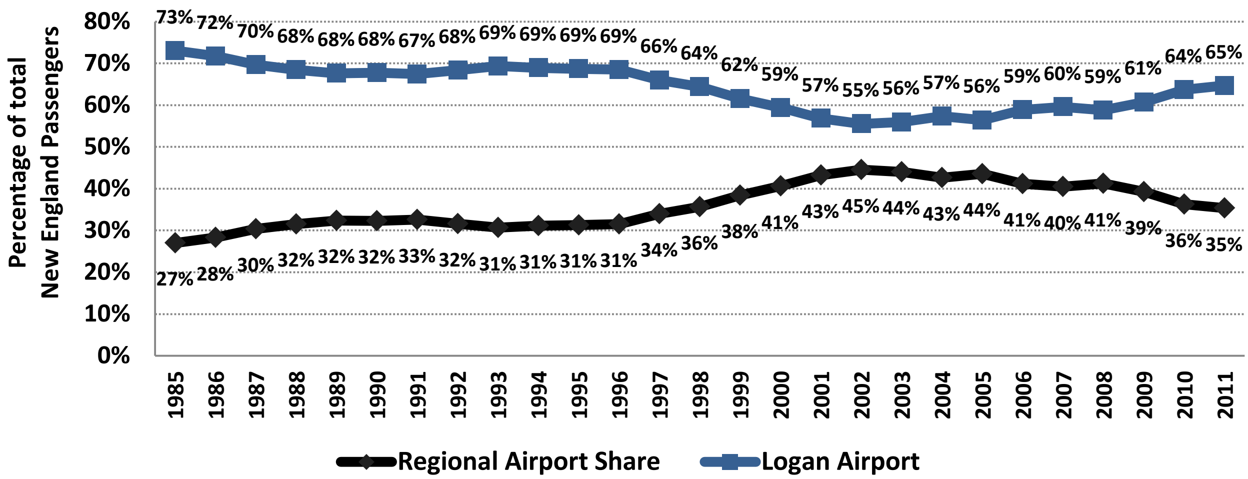
Table 4-1 Passenger Activity at New England Regional Airports and Logan Airport, 2000-2011

	Passenger Levels (millions)[1]						
Airport	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Bradley International	7.34	6.89	6.53	6.26	6.74	7.38	6.91
T.F. Green	5.43	5.53	5.39	5.18	5.51	5.73	5.20
Manchester-Boston Regional	3.17	3.23	3.36	3.60	3.97	4.33	3.90
Portland International Jetport	1.34	1.26	1.25	1.25	1.37	1.45	1.41
Burlington	0.90	1.04	1.10	1.10	1.25	1.37	1.37
Bangor	0.38	0.37	0.41	0.41	0.45	0.48	0.42
Worcester Regional [2]	0.11	0.13	0.07	0.00	0.00	0.00	0.03
Tweed-New Haven	0.08	0.06	0.04	0.03	0.08	0.13	0.08
Hanscom Field [3]	0.16	0.13	0.07	0.04	0.02	0.02	0.02
Portsmouth International [4]	0.07	0.06	0.07	0.06	0.05	0.01	0.04
Subtotal	**18.98**	**18.63**	**18.22**	**17.93**	**19.45**	**20.90**	**19.38**
Logan Airport	27.73	24.47	22.70	22.79	26.14	27.09	27.73
Total	**46.71**	**43.10**	**40.92**	**40.72**	**45.59**	**47.99**	**47.11**

	Passenger Levels (millions)[1]					Percent Change	Avg. Annual Growth
Airport	**2007**	**2008**	**2009**	**2010**	**2011**	**(2010-2011)**	**(2000-2011)**
Bradley International	6.52	6.11	5.33	5.34	5.61	5.1%	-2.4%
T.F. Green	5.02	4.69	4.33	3.94	3.88	-1.5%	-3.0%
Manchester-Boston Regional	3.89	3.72	3.18	2.81	2.71	-3.6%	-1.4%
Portland International Jetport	1.65	1.76	1.73	1.71	1.68	-1.8%	2.1%
Burlington	1.41	1.52	1.43	1.30	1.30	-0.5%	3.4%
Bangor	0.40	0.35	0.37	0.39	0.43	10.3%	1.1%
Worcester Regional [2]	0.00	0.00	0.04	0.07	0.11	57.1%	0.0%
Tweed-New Haven	0.08	0.07	0.07	0.07	0.08	14.3%	0.0%
Hanscom Field [3]	0.02	0.00	0.00	0.00	0.01	-	-22.3%
Portsmouth International [4]	0.11	0.08	0.00	0.00	0.00	-	-
Subtotal	**19.10**	**18.30**	**16.49**	**15.63**	**15.81**	**1.1%**	**-1.6%**
Logan Airport	28.10	26.10	25.51	27.43	28.91	5.4%	0.4%
Total	**47.20**	**44.40**	**42.00**	**43.06**	**44.72**	**3.8%**	**-0.4%**

Source: Massport and individual airport data reports.
Note: Data for Logan Airport includes international and connecting passengers.
1 All passengers in millions. Passenger levels are enplaned plus deplaned passengers (where available) or enplaned passengers times 2.
2 Worcester Regional Airport served fewer than 5,000, but more than 0, passengers in 2005 and 2008.
3 Hanscom Field served fewer than 5,000, but more than 0, passengers in 2008.
4 Portsmouth International passenger numbers for 2005-2008 revised to exclude through passengers.

Figure 4-3 Regional Airports' Share of New England Passengers, 1985-2011



Source: Massport and individual airport data reports.

Continued passenger declines at airports such as Manchester-Boston Regional, T.F. Green, Portland International Jetport, and Burlington International Airport offset traffic improvements at other regional airports. Manchester-Boston Regional experienced the largest passenger decline among regional airports, with passengers decreasing by 0.1 million or 3.6 percent. T.F. Green passengers decreased by 0.06 million or 1.5 percent. Among regional airports with increases in air passengers, Bradley International Airport saw the largest growth in 2011. Passenger traffic at Bradley International Airport increased by 0.3 million or 5.1 percent due to service additions by JetBlue Airways, Southwest Airlines, and Delta Air Lines.

Aircraft Operation Trends

This section reports on recent aircraft operations trends for the regional airports, including passenger aircraft operations, GA operations, all-cargo aircraft operations, and aircraft load factors.

Regional Airports Aircraft Operations

As shown in Table 4-2, total aircraft operations in the New England region (including Logan Airport) increased by 2.1 percent, from 1.07 million operations in 2010 to 1.09 million operations in 2011. Logan Airport's total operations grew by 4.6 percent (16,344 operations) compared to 2010, due primarily to a recovery in GA activity. Aircraft operations at the regional airports increased by 0.8 percent, which was only a slight change from 2010 levels (5,932 operations).

Commercial operations in the New England region remained largely flat, increasing 0.8 percent from approximately 619,600 operations in 2010 to 624,500 operations in 2011. Commercial operations were up 0.8 percent at both the regional airports and Logan Airport. This reflects an end to the trend of commercial airline operation declines in recent years, brought about by the fuel spike in 2008 and the economic recession of 2008 to 2009. However, airlines continued to monitor and control capacity carefully in 2011 even as passenger demand showed signs of recovery. The same trend was seen across the nation. Total U.S. aircraft operations declined by 1.4 percent, while U.S. passengers increased by 1.7 percent in 2011.[9]

9 Airports Council International, 2011 Worldwide Airport Traffic Report.

GA operations increased at both the regional airports and Logan Airport in 2011. Total GA operations in the New England region increased by 4.3 percent. The recovery in GA operations at Logan Airport significantly outpaced the recovery at the regional airports in 2011. GA activity began to rebound at Logan Airport in 2010 following a steep decline during 2008-2009 due to high fuel prices and economic recession. Businesses increased their travel and use of GA transportation as the economy improved. GA operations at Logan Airport increased by approximately 13,550 operations or 92.3 percent; however, the 28,230 GA operations in 2011 remain below pre-2007 levels and the 35,230 GA operations peak in 2000. The regional airports saw an increase of 4,280 operations or 1.1 percent in GA activity. Military operations at the regional airports decreased by 1.4 percent in 2011.

GA operations continue to be the dominant type of aircraft activity at the regional airports. In 2011, GA accounted for 55.7 percent of total aircraft operations at the regional airports. In comparison, GA represented only 7.7 percent of aircraft activity at Logan Airport, which primarily accommodates the region's domestic and international commercial airline operations. Commercial airline operations accounted for 39.5 percent of total operations at the regional airports, compared to 92.3 percent of total operations at Logan Airport.

Overall, the regional airports accommodated a much greater share of the region's aircraft operations than their share of air passengers due to high levels of GA traffic. While only 35.3 percent of New England's air passengers enplaned or deplaned at one of the regional airports, these airports accounted for 66.1 percent of the region's aircraft activity. On average, there were approximately 22.0 passengers per aircraft operation at the regional airports compared to 78.3 passengers per operation at Logan Airport.

While aircraft operations in the region increased slightly in 2011 compared to 2010, aircraft operations have declined significantly since 2000. Total aircraft operations fell by nearly one third, from 1.6 million in 2000 to 1.1 million in 2011. There were similarly large reductions in all three categories of activity – commercial, GA and military. A number of factors have contributed to lower levels of commercial and GA aircraft operations including the immediate effects of the September 11, 2001 terrorist attacks, reductions in short-haul commercial airline flights following post-September 11, 2001 security changes, escalating and sustained high fuel prices, economic contractions and slower growth, a declining private pilot base, a shift to larger capacity commercial aircraft, and airline service reductions. Annual aircraft operations from 2000 to 2011 are provided in *Appendix F, Regional Transportation.*

Table 4-2 Aircraft Operations by Classification for New England's Airports, 2000, 2010 and 2011

	2000				2010				2011				
Airport	**Commercial[1]**	**General Aviation[2]**	**Military[2]**	**Total**	**Commer-cial[1]**	**General Aviation[2]**	**Military[2]**	**Total**	**Commer-cial[1]**	**General Aviation[2]**	**Military[2]**	**Total**	**Share of NE Total**
Bradley International	132,062	31,863	5,811	169,736	80,418	18,759	3,028	102,205	86,838	16,483	3,630	**106,95**	9.8%
T.F. Green	103,750	52,184	2,764	158,698	60,128	21,096	347	81,571	57,194	21,774	369	**79,337**	7.3%
Manchester-Boston Regional	61,506	45,740	586	107,832	53,971	13,636	933	68,540	51,379	12,497	874	**64,750**	6.0%
Portland International Jetport	47,609	56,571	2,072	106,252	35,035	24,776	446	60,257	35,157	21,453	533	**57,143**	5.3%
Burlington	45,745	59,377	10,24	115,363	29,538	36,106	4,776	70,420	29,166	42,562	5,890	**77,618**	7.1%
Bangor[3]	21,446	34,831	26,50	82,784	16,190	20,142	15,525	51,857	16,177	19,503	13,22	**48,900**	4.5%
Tweed-New Haven	5,260	56,200	328	61,788	3,201	31,884	381	35,466	3,367	33,919	310	**37,596**	3.5%
Worcester Regional	4,029	46,518	495	51,042	1,629	41,843	572	44,044	2,017	44,050	634	**46,701**	4.3%
Portsmouth International	6,104	31,601	9,973	47,678	1,516	25,674	7,707	34,897	1,717	27,056	8,158	**36,931**	3.4%
Hanscom Field	6,572	204,512	1,287	212,371	0	161,942	1,795	163,737	750	160,840	1,409	**162,99**	15.0%
Subtotal	**434,083**	**619,397**	**60,064**	**1,113,544**	**281,626**	**395,858**	**35,510**	**712,994**	**283,762**	**400,137**	**35,02**	**718,92**	**66.1%**
Logan Airport	452,763	35,233	0	487,996	337,961	14,682	NA	352,643	340,757	28,230	NA	368,987	33.9%
Total	**886,846**	**654,630**	**60,064**	**1,601,540**	**619,587**	**410,540**	**35,510**	**1,065,637**	**624,519**	**428,367**	**35,02**	**1,087,913**	**100.0%**

	Percent Change (2000-2011)				Percent Change (2010-2011)			
Airport	**Commercial[1]**	**General Aviation[2]**	**Military[2]**	**Total**	**Commer-cial[1]**	**General Aviation[2]**	**Military[2]**	**Total**
Bradley International	-34.2%	-48.3%	-37.5%	-37.0%	8.0%	-12.1%	19.9%	4.6%
T.F. Green	-44.9%	-58.3%	-86.6%	-50.0%	-4.9%	3.2%	6.3%	-2.7%
Manchester-Boston Regional	-16.5%	-72.7%	49.1%	-40.0%	-4.8%	-8.4%	-6.3%	-5.5%
Portland International Jetport	-26.2%	-62.1%	-74.3%	-46.2%	0.3%	-13.4%	19.5%	-5.2%
Burlington	-36.2%	-28.3%	-42.5%	-32.7%	-1.3%	17.9%	23.3%	10.2%
Bangor[3]	-24.6%	-44.0%	-50.1%	-40.9%	-0.1%	-3.2%	-14.8%	-5.7%
Tweed-New Haven	-36.0%	-39.6%	-5.5%	-39.2%	5.2%	6.4%	-18.6%	6.0%
Worcester Regional	-49.9%	-5.3%	28.1%	-8.5%	23.8%	5.3%	10.8%	6.0%
Portsmouth International	-71.9%	-14.4%	-18.2%	-22.5%	13.3%	5.4%	5.9%	5.8%
Hanscom Field	-88.6%	-21.4%	9.5%	-23.2%	-	-0.7%	-21.5%	-0.5%
Subtotal	**-34.6%**	**-35.4%**	**-41.7%**	**-35.4%**	**0.8%**	**1.1%**	**-1.4%**	**0.8%**
Logan Airport	-24.7%	-19.9%	NA	-24.4%	0.8%	92.3%	NA	4.6%
Total	**-29.6%**	**-34.6%**	**-41.7%**	**-32.1%**	**0.8%**	**4.3%**	**-1.4%**	**2.1%**

Source: Massport; FAA Tower Counts; FAA Terminal Area Forecast; individual airport data reports.
1 May include some Air Taxi operations by fractional jet operators. FAA Tower counts combine some fractional jet operations with small regional/commuter airline operations.
2 Includes itinerant and local operations at the regional airports. Military operations at Logan Airport are negligible and not included in Massport counts.
3 Updated 2010 operations for Portland International Jetport and Burlington provided by airports.
4 Commercial operations at Bangor include international aircraft making a technical stop.
5 Commercial operations at Hanscom Field include Streamline operations only; other air taxi operations included with GA.
NE New England

Airline Passenger Service in 2011

Airlines can adjust service at an airport or on a specific route in two ways: one is to change the number of flights operated, and the other is to change the size of the aircraft. Changes in flight frequency and changes in aircraft size both affect the number of seats available to passengers, also known as seat capacity. Airline services are therefore typically discussed in terms of seat capacity as well as the number of flight departures.[10] This section examines changes in airline departures and seat capacity at the regional airports in 2011 and provides an overview of new and discontinued routes.

Service Developments at the Regional Airports

In 2011, a total of 16 airlines provided scheduled passenger service from the 10 regional airports to 42 non-stop destinations.[11] Scheduled commercial services increased slightly overall at the regional airports. This marks an end to the steep airline service cuts seen in recent years, with high fuel prices and economic recession forcing carriers to eliminate or reduce frequencies on less profitable routes. The regional airports were all impacted by airline service declines in previous years and saw only a gradual beginning in recovery in service levels in 2011.

Table 4-3 shows the share of scheduled domestic departures for Logan Airport and the ten regional airports in recent years for the peak travel month of August. The regional airports accounted for 42.5 percent of the scheduled departures in the New England region in August 2011, seeing little change from 42.2 percent in August 2010. Overall airline capacity at the medium-size airports – Bradley International Airport, T.F. Green Airport, and Manchester-Boston Regional Airport – remained largely the same, while the smaller airports saw a slight increase in airline services in 2011. Details of scheduled passenger operations by market and carrier for the regional airports for the years 2000 to 2011 are presented in *Appendix F, Regional Transportation*.

Table 4-3 Share of Scheduled Domestic Departures – Logan Airport and the Ten Regional Airports, 2000-2011[1]

	2000	2001	2002	2003	2004	2005
Logan Airport, MA	54.8%	54.6%	50.9%	50.0%	52.4%	49.6%
Bradley International, CT; Manchester-Boston Regional Airport, NH; T.F. Green Airport, RI	29.8%	29.2%	32.5%	32.7%	33.9%	35.1%
Bangor, ME; Burlington, VT; Hanscom Field, MA; Portland International Jetport, ME; Portsmouth International Airport, NH; Tweed-New Haven, CT; Worcester Regional, MA	15.4%	16.2%	16.6%	17.2%	13.8%	15.3%
	2006	**2007**	**2008**	**2009**	**2010**	**2011**
Logan Airport, MA	52.8%	52.2%	53.5%	55.5%	57.8%	57.5%
Bradley International, CT; Manchester-Boston Regional Airport, NH; T.F. Green Airport, RI	33.6%	33.5%	32.3%	30.3%	29.5%	29.2%
Bangor, ME; Burlington, VT; Hanscom Field, MA; Portland International Jetport, ME; Portsmouth International Airport, NH; Tweed-New Haven, CT; Worcester Regional, MA	13.6%	14.3%	14.2%	14.2%	12.7%	13.3%

Source: Official Airline Guide Market Files.
1 For the peak travel month of August.

10 A departure is an aircraft take off at an airport. While aircraft operations include both departures and arrivals, airline services are typically described in terms of departures, as the number of scheduled departures generally equals the number of scheduled arrivals. Changes in departures translate to changes in overall operations.

11 Includes Allegiant Air, Direct Air, and Streamline. Allegiant Air serves Bangor with scheduled services to Sanford and St. Petersburg. Direct Air provided regularly scheduled charter service to Myrtle Beach, Punta Gorda, Sanford, and West Palm Beach from Worcester Regional Airport in 2011. Streamline provides regularly scheduled charter services between Hanscom Field and Trenton.

Bradley International Airport

Bradley International Airport in Windsor Locks, CT was the only medium-sized airport to experience some service increase in 2011. Expanded services to Florida accounted for a large part of the scheduled departure and seat capacity increases. JetBlue Airways, which began service at the Airport in November 2010, continued twice daily narrow-body service to Fort Lauderdale and Orlando in 2011. Southwest Airlines also maintained a new twice daily service to Orlando, introduced at the end of 2010. Other service increases included US Airways adding frequencies to its New York La Guardia turboprop service and Delta Air Lines' RJ service to Washington National, which was introduced in 2010. Scheduled seat capacity at the Airport increased by 6.6 percent compared to 2010.

T.F Green Airport

T.F. Green in Warwick, RI saw continued reductions in scheduled departures and available seat capacity by the majority of airlines at the Airport. The most significant cutbacks were implemented by Southwest Airlines, which discontinued Nashville service and reduced frequencies on its Baltimore, Orlando, and Philadelphia routes. Delta Air Lines, on the other hand, introduced some service increases in 2011 following its consolidation of operations at the Airport due to the Northwest Airlines merger. Delta Air Lines launched new RJ service to Washington National in 2011 and increased the aircraft size on its Atlanta route. Delta Air Lines also began RJ service to Raleigh/Durham in 2011, but discontinued the service later in the year. Overall scheduled seat capacity at T.F. Green Airport decreased by 4.3 percent. JetBlue Airways launched nonstop service from T.F. Green to Orlando and Ft. Lauderdale on November 29, 2012.

Manchester-Boston Regional Airport

Manchester-Boston Regional Airport also experienced significant cutbacks by Southwest Airlines, United Air Lines, and US Airways in 2011. Southwest Airlines discontinued non-stop service to Phoenix and also reduced scheduled frequencies on its Baltimore, Orlando, and Tampa routes. United Air Lines cut frequencies to Washington Dulles. US Airways also reduced frequencies and aircraft size in the Charlotte market. Scheduled seat capacity at Manchester decreased overall by 7.1 percent.

Portland International Jetport

Portland International Jetport (ME) experienced a modest recovery in airline capacity. Delta Air Lines increased the size of aircrafts serving the Atlanta market, replacing RJs with narrow-body MD-88s. US Airways also increased frequencies in the Philadelphia market. Overall scheduled seat capacity increased 3.9 percent at Portland International Jetport.

Burlington International Airport

Burlington International Airport (VT) also experienced a modest increase in airline capacity. Delta Air Lines increased the aircraft size in the New York JFK market, and Continental Airlines[12] increased the aircraft size on its New York Newark route. Overall scheduled seat capacity increased by 3.5 percent at Burlington International Airport.

Worcester Regional Airport

Worcester Regional Airport lost all commercial service in 2006 when Allegiant Airlines pulled out, but then regained regularly scheduled charter service by Direct Air at the end of 2008. Direct Air started at Worcester Regional Airport with service to Punta Gorda and Sanford in 2008. Seasonal service to Myrtle Beach and West Palm Beach was added in 2009 and 2010 respectively. Direct Air expanded services considerably in 2011, increasing departures by approximately 23 percent and growing seat capacity by 31 percent compared to 2010 levels. However, Direct Air discontinued all services in March 2012.

12 In 2012 Continental Airlines merged with United Airlines.

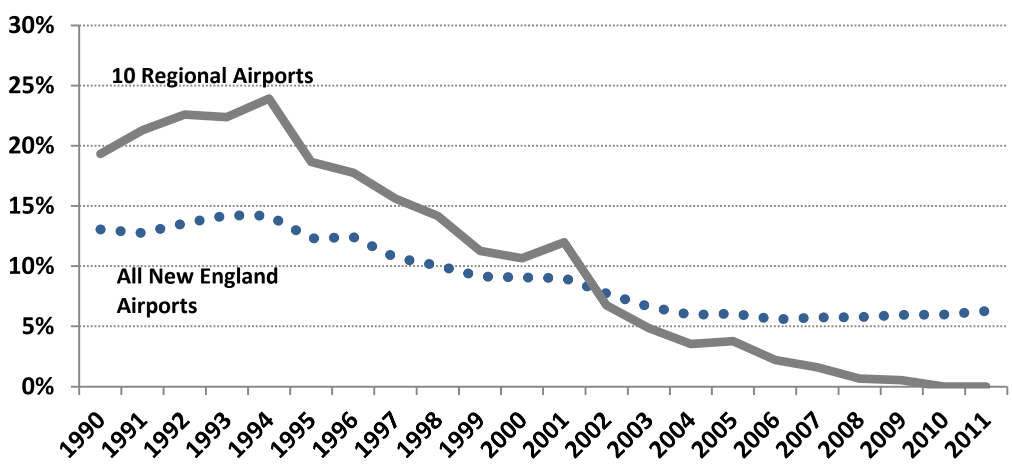
Bangor, New Haven, Portsmouth and Hanscom Airports
Among the other smaller regional airports, Bangor Airport (ME) was the only one to see a significant recovery of commercial service. Scheduled seats grew by 17.3 percent at Bangor Airport, with US Airways increasing frequencies in the Philadelphia market and Delta Air Lines also adding larger RJs on its New York La Guardia route. Tweed-New Haven Airport (CT) saw capacity on US Airways, the one carrier offering scheduled service, decline by 4.5 percent. Portsmouth International Airport (NH) and Hanscom Field (MA) both lost all scheduled service earlier in 2008 when Boston-Maine Airways discontinued service. In 2011, the public charter carrier, Streamline, introduced regularly scheduled charter service on turboprop aircraft from Hanscom Field to Trenton, NJ but this service was discontinued in September 2012. Portsmouth had not regained commercial passenger service as of 2011.

Regional Reliance on Logan Airport

Despite the service reductions at the regional airports in 2011, the trend of decreased reliance on connecting service through Logan Airport continued. Figure 4-4 shows that the share of flights between the regional airports and Logan Airport has been declining steadily since the mid-1990s. In the early 1990s, scheduled service to Logan Airport represented over 20 percent of regional airport flights. This share dropped as regional airports gained more non-stop service to both origin and destination (O&D) destinations and airline connecting hubs. In 2010, the last scheduled flights from the regional airports to Logan Airport were eliminated entirely. The significance of this trend is that it reduces pressure on Logan Airport to provide connecting service for small planes from small communities to other destinations, resulting in more convenient air service routings for passengers, and opening up capacity at Logan Airport for higher value intracontinental and international flights.

However, while service between the 10 regional airports and Logan Airport has been eliminated, other remote communities in New England continue to rely on Logan Airport for connecting services. Logan Airport acts as a connecting hub for a number of other New England airports, such as the Cape Cod and Island Airports. Logan Airport remains the sole commercial air service destination for some communities, such as Augusta, Presque Isle, and Rockland, ME, as well as Rutland, VT.

Figure 4-4 Share of Flights Originating at New England Airports with Logan Airport as Destination, 1990-2011



Source: Official Airline Guide Market Files (August for each year).
Note: Includes all New England airports with scheduled airline service.

Regional Airport Facility Improvement Plans

The following section describes significant airport improvements that are planned or under construction at the regional airports in the near future.

T.F. Green Airport

Planning for an airport-wide improvement program at T.F. Green Airport in Warwick, RI, including the proposed extension of Runway 5-23 to allow for non-stop service to the West Coast, is currently underway. The Draft Environmental Impact Statement (DEIS) was filed in July 2010 and the Final EIS for the T.F. Green Airport Improvement Program, was filed in July 2011. The FAA approved its Record of Decision (ROD) on September 23, 2011. In January 2013, the FAA published a final Written Re-Evaluation of the ROD, as project design and construction phasing changed since the ROD was issued. Extending the runway will enable the Airport to accommodate demand for long-range non-stop flights to the West Coast. Safety projects include improving the Runway Safety Areas at Runway 16-34 runway ends and resurfacing the runway, and demolishing Hangar No. 1 due to an air space penetration. Other enhancements include terminal and concourse expansion and parking and roadway improvements. Because of the potential environmental impacts associated with wetlands and community disruption, the FAA prepared an EIS to assess the proposed improvements.

The new InterLink facility near T.F. Green Airport, an intermodal transportation hub, opened on October 27, 2010. The InterLink serves multiple transportation functions, including: Rhode Island Public Transit Authority (RIPTA) bus service; Massachusetts Bay Transportation Authority (MBTA) commuter train service traveling between Warwick, Providence, and Boston; a consolidated car rental facility, and parking (for commuter rail service only); and a direct pedestrian link to the airport terminal. The rail platform is integrated with a consolidated rental car facility that houses airport rental car operations.

Manchester-Boston Regional Airport

Since the early 1990s, over $500 million was invested in Manchester-Boston Regional Airport to improve and develop landside and airside facilities and infrastructure. Projects included a 158,000 square foot passenger terminal, two 75,000 square foot terminal additions, a 4,800 space parking garage with an elevated pedestrian walkway connection to the terminal, roadway improvements, a new air traffic control tower, and extensive runway reconstruction and lengthening. Ongoing customer service enhancement initiatives have included the construction of a new cell phone lot in 2007 for motorists waiting to pick up passengers and various concessions improvements through 2008 and 2009.

Manchester-Boston Regional Airport completed an Airport Master Plan Update in 2011, an update to its previous 1997 Master Plan. The master plan update provides a blueprint for development and improvement of airport facilities and infrastructure through 2030. Upcoming projects focus on airfield pavement rehabilitation, terminal optimization, best use of landside property, and parking and roadway rehabilitation. Short-term project highlights planned for the next five years include:

- Highlander redevelopment site work associated with the demolition of the Highlander Inn and Conference Center located in the Runway Protection Zone of Runway 6
- Roadway and parking improvements
- Curbside enhancements
- Refurbishing and expansion of baggage claim equipment

- Terminal ramp replacement and taxiway rehabilitation
- Construction of a glycol collection/treatment facility
- Construction of a snow removal equipment storage building

The Manchester Airport Access Road project was completed in November 2011, providing a new exit and roadway off of the F.E. Everett Turnpike into Manchester-Boston Regional Airport. The two-mile access road provides better highway access to the airport, as well as access to 1,000 acres of prime industrial and commercial land near the airport for economic development.

Bradley International Airport

An eight-year, $200 million airport modernization project at Bradley International Airport was completed in 2010. Originally launched in 2000, the modernization project introduced a refurbished and expanded Terminal A with an additional 260,000 square feet new concourse, new ticket counters and waiting areas, major gate renovations, and a state-of-the-art security and communications system. A 28,000 square feet International Arrivals Building was also completed. Bradley International Airport is scheduled to start construction on a new Terminal B in 2012, which will include the addition of 22 domestic gates and two international gates.

In 2011, the Connecticut Airport Authority (CAA) was established to oversee the operation and development of Bradley International Airport. The CAA, a quasi-public agency consisting of an 11-member board, will manage day-to-day operations at Bradley International Airport, as well as at five GA airports in Connecticut. The goal of the CAA is to transform Bradley International Airport and the state's five GA airports (Danielson, Groton/New London, Hartford Brainard, Waterbury-Oxford, and Windham airports) into economic drivers for the state. Bradley International Airport was previously run by a board under the Connecticut Department of Transportation.

A three year-long renovation project for the airport hotel, the Sheraton Bradley Airport Hotel, was completed in 2011, featuring newly outfitted guest rooms, a redesigned lobby, and an expanded fitness center and pool. Current near-term capital improvement projects identified in Bradley's 2010-2013 Airport Strategic Plan include:

- Demolition of old Murphy Terminal and design of new terminal area;
- Associated roadway realignment and utility relocation for terminal redevelopment;
- Rehabilitation of Taxiways C North and C South; and
- Sound insulation program.

Hanscom Field

Massport has planned several airside and landside improvements at Hanscom Field, which are described in detail in the *Hanscom 2005 ESPR*[13] and the annual report on *The State of Hanscom*.[14] In Fiscal Year 2011, Massport invested approximately $3.7 million in airfield, terminal, and other facility improvements at Hanscom Field. The next Hanscom ESPR will evaluate 2012 conditions.

13 Massport. *2005 L.G. Hanscom Field Environmental Status & Planning Report* (2007).
14 Massport. *The State of Hanscom*, 2010.

In 2011, Massport received FAA AIP funds to reconstruct Taxiway S and a portion of the west ramp. The ongoing pavement reconstruction project is the one active AIP eligible project at Hanscom Field. Renovations to the Civil Air Terminal building, which began in 2010, continued in 2011. The installation of a new roofing system for the Civil Air Terminal, which included the installation of solar panels, was completed, and work on the installation of a new Access Control System for the Terminal and various airfield gates was started.

Solar Panels on Civil Air Terminal building. Source: Massport.

Other near-term airside improvements planned include relocation of perimeter roadways and ongoing approach and departure surface vegetation management. On the landside, Rectrix Aviation commenced work on the Hangar 24 facility demolition and construction of a new fixed-base operator (FBO) facility in the fall of 2012. As part of this project, a new fuel farm will also be constructed adjacent to the existing Jet Aviation fuel farm.

Worcester Regional Airport (ORH)

- Completed in 2008, the Worcester Regional Airport Master Plan was funded by the FAA and the former Massachusetts Aeronautics Commission (MAC). The Worcester Master Plan provided a strategic roadmap to guide airport development through 2020. Near-term projects focused on maintaining essential operations, safety and security functions and included runway pavement reconstruction, runway safety area upgrades, and a vegetation removal and maintenance plan. Long-term initiatives include upgraded corporate/GA facilities including a FBO facility and hangars, a new Airport Rescue and Fire-fighting Facility (ARFF) and ongoing runway and taxiway pavement rehabilitation. Various demand-driven projects including terminal enhancements and additional parking facilities were also identified; however, these projects depend on the level and type of future aviation activity realized at Worcester Regional Airport. Massport is currently pursuing enhancements to ORH's all-weather capability including upgrading the Runway 11 Instrument Landing Systems (ILS) from a Category I to a Category III system, and its associated required airfield infrastructure and navigation aids including taxiway improvements. This project is a safety and operational priority for the Airport.

The following near-term projects identified in the Worcester Master Plan were completed as of the end of 2011:

- Installed engineered materials arresting system (EMAS) on the Runway 29 End;
- Resurfaced 3,000 feet of Runway 11;
- Installed EMAS on the Runway 11 End; and
- Resurfaced 4,000 feet of Runway 29 and reconstructed Taxiway Delta.

Massport and third party developers have committed to invest in the following airside and landside improvement projects over the next few years:

- Installation of a new terminal roof and HVAC system;
- Airside and landside pavement rehabilitation;
- Rehabilitation of the existing ARFF station; and
- Rectrix Aviation is developing new FBO facilities including regional aircraft maintenance capabilities.

Long-term Worcester Roadway Improvements
In 2008, the Central Massachusetts Regional Planning Commission (CMRPC) initiated the Worcester Regional Mobility Study that was envisioned as a transportation plan with the goal of improvement of improving the movement of people and goods through the Greater Worcester Region. The final Study was released in May 2011. One of the Study's objectives was to improve ground transportation access between the regional roadways and Worcester Regional Airport within the context of an "economic development corridor" that could benefit other local businesses. Several alternative routes were identified and recommended for further study including a new interchange off the Interstate 90 in the vicinity of Route 56. The Study also assessed a range of alternatives to address regional mobility concerns and recommended thirteen roadway infrastructure improvement intended to reduce congestion, enhance regional mobility, and address existing interchange/intersection constraints. The study presented the recommended phasing and packaging of recommended alternatives into short-term (zero to five years), mid-term (five to ten years), and long-term actions (over ten years).

Near-term Worcester Directional Signage Improvement Program
CMRPC also supported Massport's goal to identify immediate actions for improving roadway access to Worcester through a signage improvement program. In collaboration with the MassDOT, the City of Worcester, Massport identified six primary routes now used by travelers to access Worcester. The team also developed a sign design and placement plan. The goal was to improve directional signage on these roads between Worcester and the Massachusetts Turnpike Pike and Interstate 290 by achieving the following objectives:

- To ensure that key decision points would be adequately signed;
- To reduce sign "clutter" by removing old and unnecessary signs; and
- To design and install new airport trailblazer signs consistent with Massport's and MassDOT's wayfinding standards.

MassDOT has installed the desired signs that were produced by the Massport Sign Shop. To date more than 80 signs have been installed including several signs on Auburn roads approved by the Town of Auburn in March 2011.

Regional Long-Range Transportation Planning

A balanced regional intermodal transportation network would reduce reliance on Logan Airport as the region's primary transportation hub and provide New England travelers with a greater range of viable transportation options. This section highlights efforts to achieve this balance through cooperative transportation planning at a broad array of transportation agencies and concerned parties to promote an integrated, multi-modal regional transportation network.

The unified MassDOT brought together many Commonwealth entities that plan, build, own, operate, and maintain all modes of transportation, under a five-member board of directors. (Massport remains an independent authority focused on airport and seaport needs with its own board of directors, including the Secretary of MassDOT.) The creation of MassDOT was intended to help integrate, coordinate, and prioritize multimodal transportation policy and investment in Massachusetts, resulting in a more effective, efficient, equitable, rational, and innovative transportation system. As a fundamental part of the transportation framework in the Boston metropolitan area, and for all of New England, Massport supports an integrated multimodal transportation policy to improve the efficient use of transportation infrastructure on both a metropolitan and a regional scale. In 2011, MassDOT continued to make strides in improving the existing transportation infrastructure by addressing structurally deficient infrastructure with innovative construction techniques, developing a comprehensive environmental responsibility and sustainability initiative, and continuing to invest in the Boston metropolitan area's rapid transit.

Logan Airport's functional role is New England's premier commercial airport, providing an essential and efficient connection between the New England states and the global economy. Recent studies have indicated that there is a serious lack of usable aviation capacity in the coastal mega-regions[15] (although not in Boston itself) and identify a need for access to alternative forms of short-distance travel across these regions.[16] Since the construction of a second major Boston airport has been judged impractical in the past, the potential of high-speed rail is increasingly being viewed as an important complementary component in the regional transportation system and aviation planning.[17] Given the comparable travel times, proximity of service to downtown Boston, and the potential for highly efficient electrified propulsion, high-speed rail could provide efficient intercity connectivity for city-pairs in a corridor up to 600 miles long, which would be competitive with air travel.[18] Boston's South Station is undergoing planning and design for expansion that would support the current and future rail mobility in Massachusetts and along the Northeast Corridor (NEC) including supporting future high-speed rail. In 2011, Amtrak services in the NEC had a 54 percent share of the Boston-New York City markets (excluding traffic by other surface modes such as private car and bus) (Figure 4-5).

Regional Aviation Economic Impact Study

The Aeronautics Division of MassDOT completed a wide-ranging economic impact study of the statewide airports system's (the 39 public use airports including Logan Airport) contribution to the economy of Massachusetts. The analysis found that Massachusetts public use airports generated $11.9 billion in total economic activity, including $4.9 billion in total annual payroll resulting from 124,369 jobs that can be traced to the aviation industry.[19] In particular, Massport's three airports are noted to make significant contributions to the regional economy generating approximately $10.3 billion or 87 percent of the overall economic benefits generated by the Massachusetts airport system.[20] Specifically, Logan Airport supported over 94,000 jobs in Massachusetts and the total economic impact is now estimated at approximately $8.87 billion per year.[21] Hanscom Field supported 11,765 jobs and a total impact of $1.4 billion while Worcester Regional Airport supported 418 jobs and a total economic impact of $51.5 million. Hanscom Field is particularly important for its function as an active military facility, which is aided by its proximity to Boston-area technology and research industry. For every $100 spent by aviation-related businesses, an additional multiplier impact of

15 The coastal mega-regions are the continuously urbanized areas along the east and west coasts of the U.S. (Washington, DC, Philadelphia, New York City, Hartford, Boston)
16 FAA: *Capacity Needs in the National Airspace system 2007-2025* (commonly referred to as FACT-2) and TRB: *ACRP Report 31: Innovative Approaches to Addressing Aviation Capacity Issues in Coastal Mega-regions.*
17 Transportation Research Board *ACRP 03-23: Integrating Aviation and Passenger Rail Planning*.
18 "Where High-Speed Rail Works Best" America 2050 - http://www.america2050.org/pdf/Where-HSR-Works-Best.pdf Page 1-2
19 Massachusetts Department of Transportation Aeronautics Division. *Massachusetts Statewide Airport Economic Impact Study Executive Summary*. (2011). Accessed January 4, 2011 <http://www.massdot.state.ma.us/portals/7/downloads/aero_economicStudy_111021.pdf>
20 Ibid.
21 Ibid.

$56 is created within Massachusetts according to the study. While the economic impact of the region's airports was the focus of the study, it also noted qualitative benefits of the state's airports including:

- Facilitating emergency medical transport
- Providing police support
- Supporting aerial surveying, photography, and inspection operations
- Conducting search-and-rescue operations
- Supporting the U.S. military and other government operations
- Providing youth outreach activities

Massachusetts Statewide Airport System Plan (MSASP)

The MassDOT Aeronautics Division completed the Massachusetts Statewide Airport System Plan (MSASP) in 2010. The MASP provides guidance to state policy makers for the long term development of the Commonwealth's airport system. It documents the status of the current airport system; provides a long term vision for the system; identifies system goals and related improvements; establishes priorities for system and airport funding; and provides supporting data and materials.

Boston and Statewide Long-term Transportation Vision

The Boston MPO developed a long-range vision for the region and its transportation network in 2035.[22] The vision described by the Boston MPO identifies the Boston metropolitan region as continuing to be an economic, educational, and cultural hub which will continue to contribute to the high quality of life. The high quality of life will be supported by a well-maintained transportation system consisting of safe, healthy, efficient, and varied options. The variety of transportation options will allow people to find jobs and services within easy reach of affordable housing, and will reduce environmental impacts thereby improving air and environmental quality. This vision is possible through attentive maintenance, cost-effective management, and strategic investment in the region's transportation system. This vision is broad-based; more specifically for the Airport, the long-range vision finds that support for air cargo is critical as the State Freight Plan[23] finds air freight shipping to grow more quickly than any other shipping mode.

Although the other New England states have statewide long-term transportation plans, Massachusetts currently does not. MassDOT is currently undertaking the Commonwealth's first statewide strategic multi-modal transportation plan known as *weMove Massachusetts*.[24] The philosophy behind *weMove Massachusetts* is that MassDOT needs to make logical, defensible, and smart choices on how to invest the agency's limited resources based on the articulated values. The goals of *weMove Massachusetts* are to engage stakeholders through a bottom-up approach as well as internal agency stakeholders in a discussion about the present and future needs of the transportation system, to build action-oriented policies based on stakeholder feedback that can serve as a bridge between MassDOT's values and investments, and to develop a forward thinking, data-driven, decision-making methodology to assist MassDOT in implementing its priorities transparently and measurably.

Massport is an active participant in the development of the Boston MPO long-range transportation plan and has a representative on the *weMove Massachusetts* Stakeholder Advisory Group.

22 Boston Region Metropolitan Planning Organization. *Paths to a Sustainable Region.* September 22, 2011.
23 Massachusetts Department of Transportation. *State Freight Plan*. September 2010.
24 https://www.massdot.state.ma.us/wemove/Home.aspx

Regional Cooperative Planning Efforts

Several regional transportation cooperation planning efforts are underway, as described below.

New England Regional Airport System Plan (NERASP)
In fall of 2006, the FAA New England Region, in concert with the New England Airport Directors and New England State Aviation Directors, completed the NERASP. The results of this study describe the foundation of a regional strategy for the air carrier airport system to support the needs of air passengers through 2020. To date, the development of that strategy has been instrumental in facilitating the investment and development of the primary commercial airport system in New England.

During preparation of the 2006 NERASP study, which analyzed the primary commercial airports in New England, the group recognized that a similar evaluation of GA would also prove useful. It would provide state aviation officials with a greater understanding of airport roles and infrastructure investment. Faced with the current struggling economy, rising airport and aircraft operational costs, declining operational activity, an aging infrastructure and with limited state and federal funds to address improvements, the importance of developing both a short-range and long-range perspective on the future performance of the New England GA airport system is clear.

New England Regional Airport System Plan – General Aviaton (NERASP-GA)
The New England state aviation officials, in partnership with the FAA, are currently conducting a study of the GA airport system in New England, including primary commercial service airports that service a GA component. This assessment of the New England GA airport system will provide state aviation officials with a common understanding of their state airport system in relation to the New England region as a whole. Assisted by this information, the FAA will be better positioned to make decisions regarding priority capital investments. Moreover, the NERASP study proved that the geographic boundary of the New England region, as well as its cultural identity, makes an overall study of New England an effective planning approach. Information on the NERASP-GA study can be found at http://www.nerasp-ga.com.

Conference of New England Governors and Eastern Canadian Premiers
The Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP) is a formally established body that coordinates regional policy programs in the areas of economic development, transportation, environment, energy, and health, among others. The NEG/ECP focuses on aviation and intercity passenger rail, particularly in the northeastern coastal mega-region, as part of a larger transportation system that needs modal balance. Efficient use of this multi-state network affects the overall viability of the highway, aviation, freight, and commuter rail transportation networks that serve the region and the nation. Improved planning coordination between airports and intercity passenger rail services and related ground transportation offers the potential to achieve complementary investments in airport and rail capacity and services. MassDOT has a representative on the NEG/ECP Transportation and Air Quality Committee which covers regional transportation issues and infrastructure development, use, and efficiency. The NEG/ECP and other policy decision makers throughout the region have been able to utilize strategies and information developed in the NERASP, which provides a framework for integrated regional aviation policy and planning. This organization serves an important function to help achieve a greater balance between air, rail, and auto trips, and ultimately help to increase overall transportation capacity without overburdening Logan Airport and the New England aviation system.

In 2011, the NEG/ECP passed a resolution on transportation which provided direction on enhancing alternative-fuel vehicle infrastructure in the region, increasing multi-modal transportation options, and improving freight and passenger rail networks.[25]

Regional Rail Transportation Initiatives

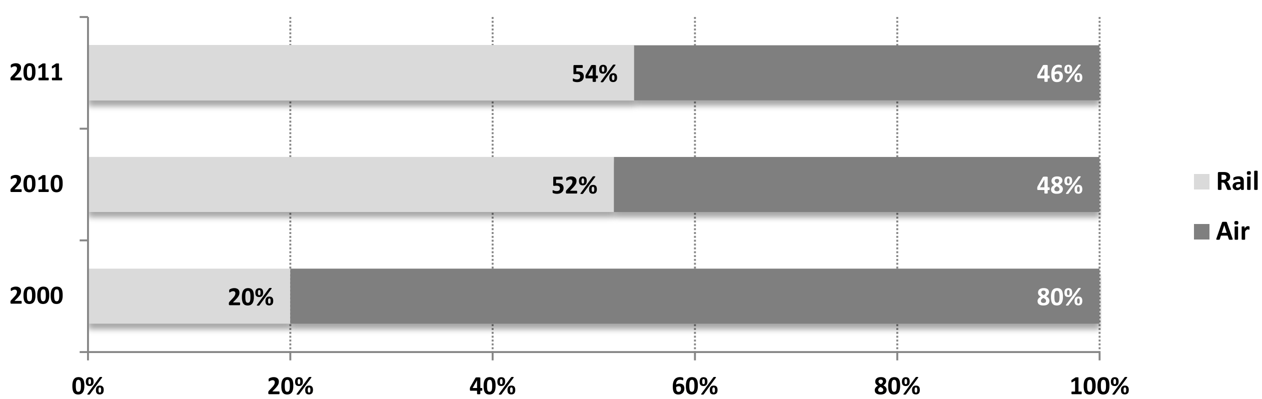
This section reports on recent developments and current rail service originating in Boston, the status of air-rail linkages in the Northeast Corridor, and the expanding Pilgrim Partnership, which provides commuter rail between Massachusetts and Rhode Island.

Amtrak Northeast Corridor

Amtrak's NEC is an intercity rail line that operates between Boston-South Station and Washington, DC via New York City. Other major destinations served by the route include Providence, RI; New Haven, CT; Philadelphia, PA; and Baltimore, MD. Logan Airport passengers can connect directly to Boston-South Station via Silver Line bus rapid transit (BRT) service or via taxi. Amtrak operates two services between Boston and Washington, DC: the Acela Express (high-speed, limited-stop service) and the Northeast Regional (lower-speed service that makes local stops along the route). Travel times on the Acela Express range from 3.5 hours from Boston to New York to just over 6.5 hours from Boston to Washington, DC. Travel times on the Northeast Regional range from about 4.25 hours from Boston to New York to approximately 7.75 hours from Boston to Washington, DC. A total of 19 daily departures are offered from Boston-South Station to Penn Station in New York, of which about half are Acela Express. Most trips continue south to Washington, DC, and a smaller number of Northeast Regional trains continue further south to Newport News, Virginia.

System-wide Amtrak ridership was 30.2 million one-way trips in Fiscal Year 2011. The NEC represented 36 percent (10.9 million) of total system-wide Amtrak ridership. In Fiscal Year 2011, the NEC carried 10.9 million passengers, an increase of 5.1 percent (0.5 million passengers) over the number of passengers in 2010 (10.4 million). Acela Express accounted for 3.4 million passengers, while the Northeast Regional accounted for 7.5 million passengers. Overall NEC ridership reached a new record in 2011, matching and surpassing the previous 2008 peak of 10.9 million passengers and up significantly from 8.4 million in 2000. Amtrak's share of the Northeast total passenger market has increased substantially since the introduction of Acela service in 2000. In 2011, Amtrak captured approximately 54 percent of the total air/rail market between Boston and New York, compared to 20 percent in 2000, as shown in Figure 4-5.

Figure 4-5 Rail-Air Market Share within the Northeast Corridor - Boston-New York City, 2000-2011



Source: Amtrak.

25 Conference of New England Governors and Eastern Canadian Premiers. Resolution 35-4, "Resolution Concerning Transportation". July 11, 2011.

Recent forecasts of Amtrak ridership along the NEC indicate that ridership could reach 17.4 million passengers in 2020, 26.2 million passengers in 2030, and expand to 43.5 million passengers in 2040. This forecast indicates that the substantially reduced travel times of high-speed rail transportation would become more attractive along the NEC.[26]

Northeast Corridor Infrastructure Master Plan and Next-Generation High Speed Rail Plan

The *Northeast Corridor Infrastructure Master Plan*, a new regional rail planning study, was released in May 2010. The Master Plan documents NEC growth needs through 2030, including expanded capacity and improvements in Boston-New York and New York-Washington intercity travel times. A 76 percent increase in rail ridership from 13 million to 23 million[27], a 36 percent increase in train movements from 154 average weekday to 210 average weekday, and the need for $52 billion in additional capital investment is expected over the next 20 years.

Following up on the release of the Northeast Corridor Infrastructure Master Plan, Amtrak also unveiled a Next-Generation High-Speed Rail proposal in September 2010 titled *A Vision for High-Speed Rail in the Northeast Corridor*. The proposal outlines a brand-new 426-mile two-track corridor running from Boston to Washington, offering high-speed rail service with sustained maximum speeds of 220 mph. The route would allow for an 84-minute trip time between Boston and New York and a three-hour trip time between Boston and Washington. Under this Next-Generation high speed rail plan, the New York City – Boston market would see a further shift from auto and air to rail due to the dramatic improvements in rail travel times, and projects the air market between the two city-pairs to be nearly eliminated by 2050.[28] This plan states that traveler's shift to high speed rail would reduce delays on competing modes (air and auto) and the shift away from shorter and smaller intraregional flights would free up air transport capacity for higher-value transnational and international flights.[29]

An update to the *Northeast Corridor Infrastructure Master Plan* and *A Vision for High-Speed Rail in the Northeast Corridor* was released in July 2012. Since these two documents were released, the two programs have been integrated into a single coherent service and investment program, called the Northeast Corridor Capital Investment Program. The Northeast Corridor Capital Investment Program would advance the near-term projects outlined in the Master Plan to benefit the NEC while incrementally phasing improvements to the Acela high-speed service to support the next-generation high-speed rail proposed.[30] The near-term NEC improvements are identified to occur between 2012 and 2025 and the long-term Next-Generation High-Speed Rail improvements are identified to occur between 2025 and 2040. The publication of the 2012 update is the first step in "improving the NEC for all users in order to sustainably support the population and economic growth facing the Northeast over the next 30 years" but considerable more planning work is required by all stakeholders.[31]

In 2011, the U.S. DOT awarded Amtrak and the New York State DOT $745 million for two high-speed rail projects on the Northeast Corridor. A major upgrade to tracks and overhead wires will be conducted along a 24-mile stretch in New Jersey, allowing for an improvement in Acela express train speeds from 135 mph today to 160 mph. Improvements to the Harold railroad interlocking in Queens, NY will also be completed, eliminating delays and reducing commuting time for Amtrak riders.

26 "The Amtrak Vision for the Northeast Corridor: 2012 Update Report." Amtrak. July 2012.
27 Includes ridership on Amtrak and state rail lines, but excludes ridership on commuter rail lines.
28 "A Vision for High-Speed Rail in the Northeast Corridor" Amtrak September 2010, Page 21.
29 Ibid.
30 "The Amtrak Vision for the Northeast Corridor: 2012 Update Report." Amtrak. July 2012.
31 Ibid. pg. v.

Boston-South Station Expansion

In support of the Northeast Corridor Capital Investment Program, MassDOT is currently designing and planning the expansion of the Boston-South Station to meet the infrastructure and capacity needs of the NEC. At present, South Station operates above its design capacity for efficient train operations and orderly passenger queuing. Operating with only 13 tracks, the current South Station constrains the current and future rail mobility within Massachusetts and through New England and the NEC.[32] The proposed expansion of South Station will result in the following benefits to rail mobility:[33]

- Improve the performance of existing and future high-speed and intercity passenger rail service to and from Boston. Today's NEC on-time performance is approximately 85 percent for Acela Express and 75 percent for Northeast Regional trains. The 2030 target for on-time performance is 95 percent for Acela Express and 90 percent for Northeast Regional. Without expanding South Station and its support facilities, not only will these targets be missed, but on-time performance will deteriorate even further in the future.
- Enable growth in high-speed and other intercity passenger rail service in the northeastern U.S., at a time when both the roadway and aviation networks are at or over capacity.
- Support sustainable economic growth and improved quality of life in NEC metropolitan areas, including Boston.
- Support a more attractive and increased MBTA Commuter Rail service, with associated benefits such as increased statewide transportation access, environmental sustainability, and improved personal mobility.

In order for the South Station track expansion to be implemented as currently conceived by MassDOT, the existing U.S. Postal Service (USPS) General Mail Distribution Facility located adjacent to South Station must be relocated. The USPS has undergone a national study of its facilities for streamlining and consolidation. While that process is still continuing, it is currently assumed that the USPS facility will remain in its current location and thus needs to be relocated for track expansion to occur. Massport has worked cooperatively with MassDOT, the MBTA and the USPS to identify a site on Massport property in South Boston that could be the recipient site of a relocated USPS facility should that become necessary.

Commuter Rail Services

The Pilgrim Partnership is an arrangement between the MBTA and the Rhode Island Department of Transportation (RIDOT), under which RIDOT allocates some of its federal funding to the MBTA in return for commuter rail service to Boston from Rhode Island. Sixteen daily round-trips are provided between Boston and Providence. Expanded commuter rail service to T.F. Green Airport in Warwick, RI was introduced in December 2010. Travel time between Boston and Warwick is approximately 1.25 hours, and 10 of the 16 daily Boston-Providence departures currently continue on to Warwick. Expanded service to Wickford, RI is commenced in 2012, with an eventual extension down to Kingston, RI also planned.

The extended commuter rail enhances ground access options from the Boston metropolitan area to T.F. Green Airport. The passenger catchment areas of T.F. Green Airport and Logan Airport overlap, and this new commuter rail service has the potential to attract passengers in the overlapping catchment area living along the Providence/Stoughton MBTA commuter rail line to T.F. Green Airport.

32 "Boston South Station High Speed Intercity Passenger Rail Expansion Project." Massachusetts Department of Transportation. August 6, 2010.
33 Massachusetts Department of Transportation. "South Station Expansion Project Website." http://www.massdot.state.ma.us/southstationexpansion/Home.aspx. Accessed August 2, 2012.

Other Regional Cooperative Planning Efforts

Recognizing that Logan Airport is a substantial trip generator and key transportation resource in the metropolitan area, Massport participates in several interagency transportation planning forums pertaining to enhancing a variety of travel modes.

GreenDOT

GreenDOT is a comprehensive sustainability initiative with three primary goals: reduce greenhouse gas (GHG) emissions; promote the healthy transportation options of walking, bicycling, and public transit; and support smart growth development. GreenDOT is MassDOT's policy mechanism to achieve the GHG reduction targets set out in the Executive Office of Energy and Environmental Affairs (EOEEA) GHG reduction plan enabled by the Global Warming Solutions Act of 2008. Massport is fulfilling the intention of GreenDOT by working to reduce GHG emissions associated with surface transportation to the Airport, and by providing more accommodations for walking, bike and public transit. MassDOT's mode shift goal is to triple the current mode share of bicycling, public transit, and walking, each by 2030. Massport supports GreenDOT's smart growth development goal by actively working to improve public transportation in the metropolitan area, a key component of smart growth principles (information on GreenDOT provided at www.massdot.state.ma.us/GreenDOT.aspx).

Massport has participated in an interagency Transportation Sustainability Committee organized by MassDOT, leading up to the development of MassDOT's GreenDOT Implementation Plan. The final GreenDOT Implementation Plan was completed in December 2012 and developed to serve as the framework for embedding the sustainability goals of GreenDOT into the core business and culture of MassDOT. The Implementation Plan captures current MassDOT innovations, leading sustainability policies of the Commonwealth, and national best practices and presents a guide to achieve the sustainability and livability vision of MassDOT.[34] The Implementation Plan identifies fifteen sustainability goals organized under seven sustainability themes: Air; Energy; Land; Materials; Planning, Policy & Design; Waste; and Water. These goals work towards decreasing resource use, minimizing ecological impacts, and improving public health outcomes from MassDOT's operations and planning processes.

Healthy Transportation Compact

The Healthy Transportation Compact interagency initiative brings together the state departments of Health and Human Services, Energy and Environmental Affairs, the Commissioner of Public Health, the MassDOT Highway Division and the MassDOT Rail and Transit Division with the intention of facilitating transportation decisions that balance the needs of all transportation users, expand mobility, improve public health, support a cleaner environment and create stronger communities. Actions include facilitating better accommodations for those with mobility limitations, increasing opportunities for physical activities, increasing bicycle and pedestrian travel through additional, safer and better connected bicycle and pedestrian infrastructure, a statewide complete streets policy, implementing health impact analyses for transportation decisions, and the federal Safe Routes to School program.

Massport activities at Logan Airport will support the Healthy Transportation Compact through its ongoing development of the Southwest Service Area and North Cargo Area. The projects include an improved pedestrian environment for employees, neighborhood residents and visitors. Streetscape improvements and new pedestrian and bicycle routes strengthen connections between the neighborhood, terminals, airport buffers, mass transit and the Harborwalk (a multimodal off-road path), Bremen Street Park and the Greenway Connector; as well as the Logan Office Center and the on-airport shuttle bus. Pedestrian actuated crossings are planned at signalized intersections along Harborside Drive and sidewalks provided along Harborside Drive,

34 "Draft GreenDOT Implementation Plan." Massachusetts Department of Transportation. June 2012.

Jeffries Street, and Porter Street. Midblock crossings or crosswalks at unsignalized intersections will consider street and pedestrian level lighting, as well as advanced warning signs and/or systems, as necessary. As described previously, bicycle access and parking is planned in secured locations for public and employee use.

Boston Metropolitan Planning Organization (Boston MPO)
Massport supports multimodal transportation planning and improving integration with its facilities through its permanent voting membership on the Boston MPO, providing input on policy and programming decisions.

MPOs are established in large metropolitan areas and are responsible for conducting a federally required cooperative, comprehensive, and continuous metropolitan transportation planning process. Based on this planning, MPOs determine which surface transportation system improvements will receive federal capital (and occasionally, operating) transportation funds. The Boston MPO´s mission is to establish a vision and goals for transportation in the region and then develop, evaluate, and implement strategies for achieving them.

Massport plays an active role on the MPO's decision-making board, participating in policy decisions related to the Long-range Regional Transportation Plan and project programming for the Transportation Improvement Program. The MPO also guides the work conducted by Central Transportation Planning Staff (CTPS) via its Unified Planning Work Program. CTPS is occasionally used by Massport to support its ground transportation planning initiatives.

Metropolitan Area Planning Council (MAPC)
Massport is also an ex-officio member of MAPC, which is a regional planning agency serving the people who live and work in Metropolitan Boston. The MAPC mission is to promote smart growth and regional collaboration, which includes protecting the environment, supporting economic development, encouraging sustainable land use, improving transportation, ensuring public safety, advancing equity and opportunity among people of all backgrounds, and fostering collaboration among municipalities. MAPC membership includes 101 municipal government representatives, 21 gubernatorial appointees, 10 state officials (including Massport), and three City of Boston officials. A staff of approximately 40 individuals supports the Council and its Executive Committee of 25 selected members. Massport is not currently an executive committee member.

Summary of Regional Long-Range Transportation Planning Efforts

The aim of regional transportation planning efforts is to reduce reliance on Logan Airport, and to provide New England travelers with a variety of viable transportation options. The NERASP study conducted in 2006 has helped to develop the primary commercial airport system in New England in order to support these benefits. Meanwhile, the NEG/ECP works to coordinate the highway, aviation, freight, and commuter rail transportation networks. Rail service such as the Amtrak Northeast Corridor and proposed improvements such as the Boston-South Station Expansion, also help to balance the passenger load among various forms of transportation. Other supporting planning forums include GreenDOT, the Healthy Transportation Compact, and Boston MPO.

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Ground Access to and from Logan Airport

Introduction

This chapter describes Massachusetts Port Authority's (Massport) achievements in improving Logan Airport's connectivity by diversifying ground transportation options (for passengers and employees) and reducing reliance on automobile travel to and from Logan Airport. Multimodal connectivity is an important element of airport planning, design and operations, affecting the daily travel choices that passengers and employees make. Improving the multimodal connectivity of the Airport can provide environmental benefits by reducing greenhouse gas (GHG) emissions associated with travel to and from Logan Airport. Offering a range of multimodal transportation options also reduces transportation costs and improves customer service for air passengers, employees, and other Airport users.

This chapter reports on ground access to and from Logan Airport from the Boston metropolitan area. Ground access conditions in 2011 are compared to 2010 conditions, as well as forecast future conditions in 2030, the long-range planning horizon. The predicted vehicle miles traveled (VMT) at Logan Airport is based on the projected passenger activity levels in 2030. For further information on the development of the 2030 long-range forecast, refer to *Chapter 2, Activity Levels.*

Regional transportation efforts as they relate to the Airport and planning efforts to diversify transportation options in the New England region (primarily through commuter, passenger, and high-speed rail) are discussed in *Chapter 4, Regional Transportation.*

Key Findings

Highlights of ground access and surface transportation to Logan Airport in 2011 include:

On-Airport Transportation and Activity

- The total number of annual air passengers at Logan Airport increased 5.4 percent to 28.9 million, compared to 27.4 million in 2010. During the same period, average daily traffic on Airport roadways increased by 5.6 percent from 94,179 vehicles per day in 2010 to 99,449 vehicles per day in 2011. Even with almost a million additional passengers, traffic volumes remained lower than those experienced in the mid-decade years. In 2007, which was the most comparable year to 2011 in terms of overall Airport

passenger activity levels in the last decade, the average daily traffic was 110,690 vehicles per day, or 10 percent higher than 2011 levels.[1]

- Massport began using an updated, more detailed, micro-simulation tool to model, calculate and analyze VMT on the Airport roadway system. The new model (VISSIM) calculated a VMT increase of 2.9 percent from 2010 to 2011. Using the previous model would have shown a 5.7 percent increase in VMT. This difference can be attributed to the new model having better calibration of on-Airport mode share among different users and reflecting more accurate roadway geometry.
- Similar to the trend in traffic volumes, VMT has shown an overall decline in comparison to the number of air passengers at Logan Airport. The average weekday VMT was 7 percent higher in 2007 than 2011 levels, although there were fewer air passengers using the Airport in 2007 (800,000 fewer in 2007 than 2011).[2]
- The number of vehicles that parked on-Airport (measured by the revenue parking exits) increased by nearly 4 percent from 2,582,453 in 2011 compared to 2,494,019 in 2010, but remained well below historic high levels. (In the past 12 years, the highest level was recorded in 2000 at 3,423,118 parked vehicles.) Massport was in compliance with the Logan Airport Parking Freeze throughout 2011.
- In March 2011, Massport completed construction of the Logan Airport Parking Deck Project, now known as the Economy Parking Garage. Located in the North Cargo Area (NCA) on the former Economy Lot 2, the garage allowed the consolidation of commercial overflow parking spaces at various locations into a single parking facility.

Ground Access Activity

- Massachusetts Bay Transportation Authority (MBTA) Silver Line bus boardings at the Airport continued to grow, increasing by over 8 percent in 2011, while Blue Line transit boardings at Airport Station remained relatively level compared to 2010. MBTA ridership on the Blue and Silver Lines has been increasing steadily over the past several years, increasing over 50 percent since 2007.
- In the summer of 2012, Massport initiated a pilot program that allowed passengers free boarding on the Silver Line at Logan Airport. (The program also entailed added customer service staff during peak arrivals periods in the summer and increased public transportation signs and wayfinding.) The promising results of this program showed reduced dwell times and faster travel times through the terminal area, which resulted in extension of the free-fare program through June 1, 2013.
- In 2011, ridership on all types of water transportation to the Airport increased by about 3 percent in comparison to the previous year. However, ridership on the MBTA ferry has been decreasing steadily over the last several years. Overall ridership on water transportation has decreased 16 percent since 2007 with most of the ridership loss occurring on the MBTA ferry service, while there has been a slight increase in water taxi use since 2007.
- In 2011, air passenger ridership using Logan Express bus service increased about 1 percent compared to 2010 levels, whereas employee use of Logan Express increased by almost 15 percent, from 467,020 in 2010 to 536,513 employee passengers in 2011. Since 2007, there has been a decrease in air passenger ridership on Logan Express (147,921 fewer passengers or a 19 percent decrease). However, this has been counter-balanced by increased employee use (132,291 more employees or a 33 percent increase) keeping overall Logan Express ridership steady since 2007. Employee ridership now accounts for about 45 percent of the service's total ridership.

1 In 2007, there were 28,102,455 air passengers at Logan Airport, approximately 800,000 fewer than in 2011, in which there were 28,907,938 air passengers.
2 Comparison of 2007 and 2011 used the previous VMT model for year over year comparison accuracy.

- Limousine/shared-ride van ridership increased by an estimated 10 percent, and taxi dispatches increased 6 percent in 2011 compared to 2010. After showing some declines in limousine ridership during the Economic Recession of 2008/2009, it has since rebounded, showing an overall increase of 8 percent since 2007 levels.

Ground Transportation Mode Shares

- The *2010 Logan Airport Air Passenger Ground-Access Survey* indicates that share of high-occupancy vehicles (HOV) modes to the Airport has returned to 2004 levels (at 30 percent HOV mode share). This represents a 2 percent increase in HOV mode share from the levels reported in the *2007 Air Passenger Ground Access Survey*.
- Logan Airport continues to rank among the top U.S. airports with respect to HOV/transit/shared-ride mode share. It is useful to note, however, that there is no standard aviation industry definition with respect to categorizing ground access modes as HOV versus single-occupancy vehicle (SOV). While some modes (e.g., Logan Express and the Silver Line) clearly fall into the HOV mode category, the proper category of a limousine or taxi is less clear. For example, if Logan Airport ground access mode shares were recalculated using the same category definitions as are used by San Francisco International Airport (SFO), the Logan Airport HOV mode share would exceed 40 percent, ranking Logan Airport higher than SFO for HOV mode share.
- Moreover, many private passenger vehicles arrive at Logan Airport with several occupants. In fact, the 2010 survey indicates that 69 percent of private vehicles carried two or more air passengers, for an average of 2.3 air passengers per private passenger vehicle. Thus, to be consistent with current transportation planning practice, vehicle occupancy would serve as a more representative measure of ground access activity and mode choices. If access mode shares were defined based on occupancy rather than type of vehicle category, Logan Airport's HOV share of ground-access trips would be 71 percent.

2030 Vehicle Miles Traveled (VMT) Projections and Future Parking Demand

- Annual air passenger levels are predicted to increase 37.8 percent or to 39.8 million by 2030. A 20 percent increase in VMT is projected by 2030. This is compared to a nearly 9 percent decrease in VMT realized over the past 10 years (even as annual air passenger levels in 2000 and 2010 were about the same).
- Peak parking demand (the number of spaces needed to accommodate parked vehicles on the peak day of the year) at Logan Airport is already at practical parking capacity level. Thus, as air passenger levels increase, as suggested by the 2030 forecasts, Massport will not be able to accommodate the potential additional parking demand on-Airport with the existing Logan Airport Parking Freeze in place. Much of this travel demand to the Airport will have to occur via other modes. The challenge is how to influence a shift so that the passengers generating the excess parking demand are encouraged to use sustainable HOV transportation modes rather than increasing taxi or private vehicle drop-off and pick-up activity that would generate unacceptable levels of curbside congestion (and associated emissions). Recent analyses suggest that by constraining parking at Logan Airport, vehicle trips to the Airport would increase in the form of curbside drop-offs by taxis and private vehicles. This is a key planning issue that Massport will address in future airport-wide strategic planning efforts.

Methodology

The methodologies for collecting gateway traffic volumes and calculating VMT are described below.

Gateway Traffic Volumes

Gateway roadways are defined as access points to/from Logan Airport, which include the Route 1A roadway ramps, Ted Williams Tunnel (TWT) (Interstate 90) ramps, Frankfort Street/Neptune Road, and Maverick Street.

All of the Airport's gateway roadways are now equipped with permanent traffic count stations, as part of the airport-wide Automated Traffic Monitoring System (ATMS). These stations provide data to calculate:

- AADT, annual average daily traffic
- AWDT, annual average weekday daily traffic
- AWEDT, annual average weekend daily traffic

Since the data are collected continuously throughout the year, seasonal adjustment factors are only necessary when significant gaps in the data occur (typically due to equipment issues or construction activity). When seasonal adjustment factors are used, these are based on a combination of the seasonality (monthly variation) of counts from other ATMS stations, air passenger levels, and parking exits. On occasion, traditional automated traffic recorder (ATR) counts are collected to supplement the ATMS data.

Vehicle Miles Traveled (VMT)

VMT is calculated as the total number of miles traveled by all vehicles within the Logan Airport roadway system. VMT is an important metric because it is used to calculate motor vehicle air quality emissions, and it is one indication of the traffic levels on roadways within specific areas and at specific times.

VMT on Logan Airport has historically been calculated using a model that was developed for the Logan Airport roadway system that was in place in 1994. The VMT model functions by distributing current-year gateway volumes throughout Logan Airport based on historical volume and mode share data to estimate roadway volumes and, ultimately network VMT. A factor is applied to the AWDT VMT to determine AM peak hour, PM peak hour, and highest 8-hour VMT each year. The roadway infrastructure at the Airport and how vehicles travel through the Airport have changed substantially since 1994. With the introduction of new roadways, ramps, and destinations at Logan Airport and new VMT reducing strategies, adapting the original model to these changes has become more challenging. To take into account these changes, a new VMT (VISSIM)[3] model was used to estimate 2011 VMT; this model can be easily adapted to reflect changes in the evolving Logan Airport roadway transportation network.

Three years ago, Massport developed a microscopic traffic simulation model of the 2007 Logan Airport transportation network using VISSIM. The VISSIM model is reflective of evening peak hour traffic conditions. One of the benefits of using the VISSIM model over the previous VMT model is that the VISSIM model can be easily updated with new infrastructure configurations, traffic volumes, vehicle routing, and VMT reducing strategies. Given the changes anticipated for Logan Airport in the near-term and in the long-term, this model will greatly improve the accuracy of results and of future projections. Another benefit of using VISSIM to determine VMT is that the program can make judgments based on travel times,

3 PTV America. (2011). Verkehr In Städen Simulationsmodell- VISSIM version 5.40 [computer software]. Portland, OR.

congestion, and driver behavior to route vehicles through the network when historical data are not available for calibration. For example, this could show how a new traffic signal might change the flow of traffic in the network, or how a new taxi route could change travel times along a particular route.

The VISSIM model was developed for a larger study area than the original VMT model, which only focused on the major Airport gateways, the circulation roadways, and the terminal areas. The VISSIM model now accounts for a larger on-Airport study area from Lovell Street and the NCA to Harborside Drive and the South Cargo Area (SCA), and includes the Southwest Service Area (SWSA). The overall VMT growth due to the slightly larger study area is negligible. The study area of the VISSIM model roadway network can be found in *Appendix G, Ground Access*. The VISSIM model not only estimates VMT associated with curbside activity and parking, but also with Logan Airport operations, rental car activity, and hotel activity.

To deploy the VISSIM model to estimate 2011 VMT, updates were made to the mapped Logan Airport road network against which the model was calibrated. Since the development of the model, some destinations (such as the taxi pool) have been relocated, vehicle routes have changed, and volumes have grown. All of these changes were accounted for in the VISSIM model. The model was calibrated to existing PM peak hour volume data to improve the accuracy of the results. Similar to the VMT model, calibration factors were determined to calculate morning, highest 8-hour, and average weekday VMT from the updated VISSIM model. Tables provided in *Appendix G*, *Ground Access* compare existing and simulated traffic volumes at Logan Airport for the 2011 condition.

On-Airport Transportation in 2011

This section reports on Massport's monitoring and management of:

- Traffic conditions, including traffic volumes and VMT calculations for 2011
- Parking conditions, including parking supply and demand, parking rates and parking facilities
- Parking programs (including preferred parking for hybrid vehicles)
- Pedestrian and bicycle parking facilities updates.

Central to these components is Massport's leadership and commitment to developing, promoting, and providing alternative means of ground transportation for access to and from Logan Airport. The diverse range of environmentally-responsible transportation modes to access the Airport by air travelers, employees and other Airport users has reduced reliance on automobile travel, thus reducing traffic congestion and contributing to improvements in air quality.

Traffic Conditions (2011)

Figure 5-1 shows the roadway infrastructure at Logan Airport in 2011. Geometric improvements and modifications at four intersections began in the late fall of 2010 as part of the enabling projects of the SWSA Redevelopment/Consolidated Rental Car (ConRAC) facility project. These roadway changes were fully implemented in the spring of 2011 and are analyzed in *2011 ESPR*. The new, but temporary/relocated bus/limousine pool opened February 1, 2011, and is included in the 2011 VMT analysis.

Gateway Traffic Volumes

Table 5-1 summarizes the daily gateway traffic volumes at Logan Airport for the years 2000 through 2011. It includes annual average daily traffic (AADT), annual average weekday daily traffic (AWDT), annual average weekend daily traffic (AWEDT), and annual air passengers, for reference.

The AADT entering and departing Logan Airport via its gateway roadways increased by 5.6 percent between 2010 and 2011. This increase in average daily traffic can be attributed to:

- A 5.4 percent increase in air passenger activity in 2011;
- A 6 percent increase in taxi dispatches; and
- A 4 percent increase in parking activity (exits).

Although the highest passenger levels recorded since 2000 at Logan Airport were in 2011, the traffic volumes remain lower than those experienced in the mid-decade years with almost a million fewer passengers. In 2007, which was the most comparable year to 2011 in terms of overall Airport passengers in the last decade, the AADT was 110,690, or 10 percent higher than 2011 levels.

In May 2008, a card-access controlled gate was installed at the Maverick Street gateway to limit Airport-related vehicle traffic in the Jeffries Point residential neighborhood. Access through this gate is exclusively for registered East Boston residents. The analysis of gateway volumes and VMT characteristics continue to reflect this shift in traffic from local streets to Route 1A.

Vehicle Miles Traveled
Consistent with previous years, the following specific time periods were analyzed for 2011:

- Morning peak hour (AM Peak Hour);
- Evening peak hour (PM Peak Hour);
- Highest consecutive 8-hour (High 8-Hour); and
- Average AWDT.

Table 5-2 summarizes the VMT estimates for Logan Airport-related traffic from 2000 through 2011 using the old VMT model (for comparison purposes to previous years), and includes the new VISSIM model results for 2011. The VMT for Airport-related traffic increased by 5.7 percent in 2011 compared to 2010 as calculated by the old VMT model and 2.9 percent in 2011 compared to 2010 based on the new VISSIM model. This increase in VMT can be attributed to an increase in annual passengers at the Airport and a change in distribution of traffic volumes among the different gateways.

Similar to the trend in traffic volumes, VMT has shown an overall decline in comparison to the number of air passengers at Logan Airport. The most comparable year to 2011 in terms of overall Logan Airport passengers was 2007, however, average weekday VMT was 7 percent higher in 2007 than 2011 levels.

Details of the 2011 VMT modeling results are presented in *Appendix G, Ground Access*.

Figure 5-1 Logan Airport Roadway Network, 2011

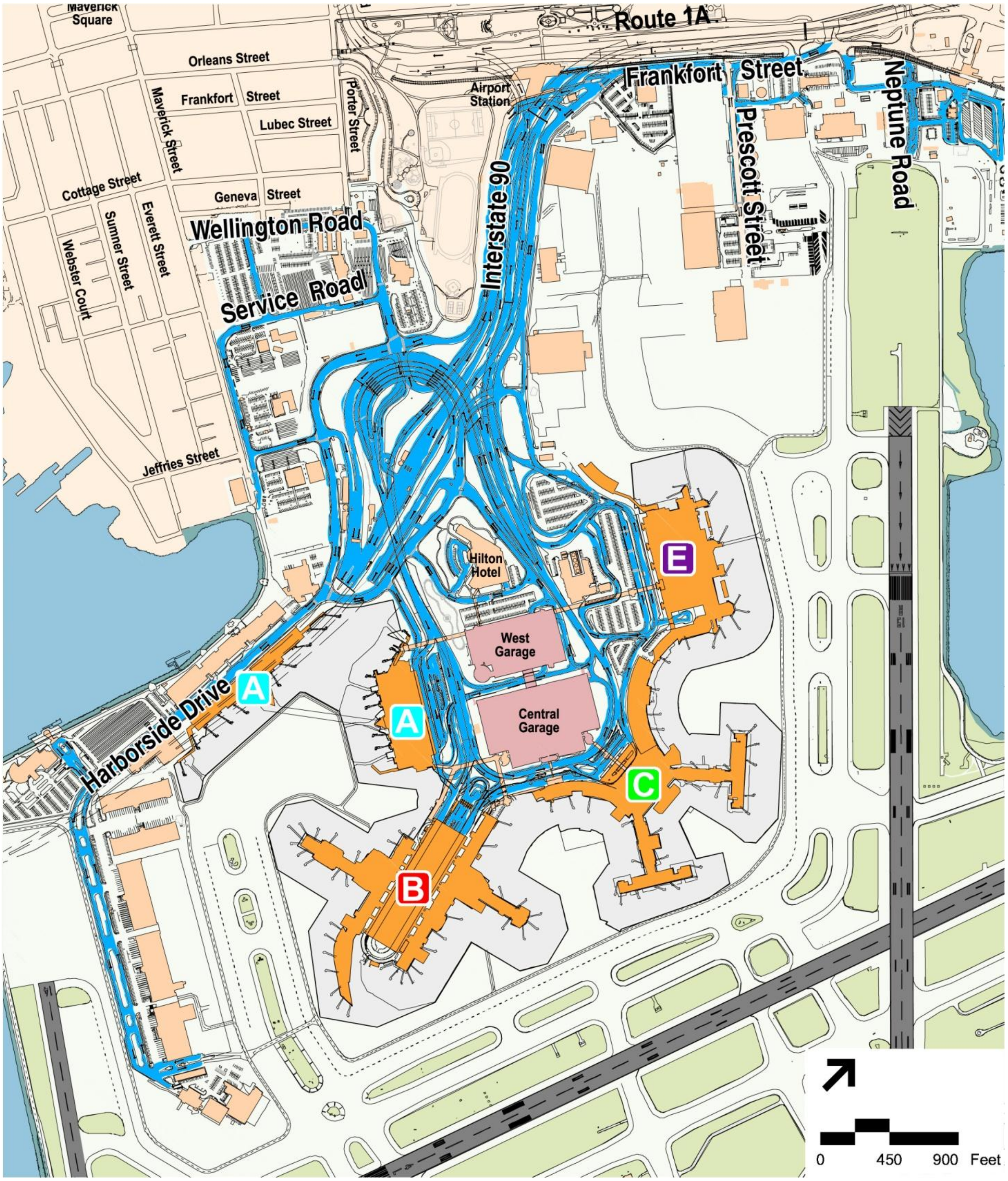


Table 5-1 Logan Airport Gateways: Annual Average Daily Traffic, 2000 - 2011								
	AADT		AWDT		AWEDT		Annual Air Passengers	
Year	Volume	Percent Change	Volume	Percent Change	Volume	Percent Change	Level of Activity	Percent Change
2000	95,058	3.8%	101,446	3.9%	78,358	2.1%	27,412,926	1.3%
2001	86,811	(8.7%)	91,588	(9.7%)	74,911	(4.4%)	24,474,930	(11.7)%
2002	84,927	(2.2%)	89,731	(2.0%)	73,398	(2.0%)	22,696,141	(7.3%)
2003 [1,2]	88,978	4.8%	*93,680*	4.4%	*77,239*	5.2%	22,787,169	0.4%
2004	100,206	12.6%	106,278	13.4%	84,950	10.0%	26,142,516	14.7%
2005	106,000	5.8%	112,600	6.0%	89,400	5.2%	27,087,905	3.6%
2006 [3]	NA	NA	NA	NA	NA	NA	27,725,443	2.4%
2007	110,690	4.4%	119,200	5.9%	91,320	2.1%	28,102,455	1.4%
2008	96,187	(13.1%)	100,107	(16.0%)	80,797	(11.5%)	26,102,651	(7.1%)
2009	89,575	(6.9%)	93,670	(6.4%)	78,905	(2.3%)	25,504,845	(2.3%)
2010	94,179	5.1%	98,968	5.7%	82,595	4.7%	27,428,962	7.5%
2011	**99,449**	**5.6%**	**104,863**	**6.0%**	**85,879**	**4.0%**	**28,907,938**	**5.4%**

Source: Massport
Notes: Numbers in parentheses () represent negative numbers.
1 For years between 1999 and 2003, total gateway volumes are adjusted to eliminate TWT- Route 1A through traffic not destined to or from Logan Airport.
2 Based on a ratio of AADT/AWDT from previous years and based on a ratio of AWEDT/AWDT from previous years.
3 Gateway traffic volumes were not collected in 2006 due to the temporary closure of the TWT.
AADT Annual average daily traffic.
AWDT Annual average weekday daily traffic.
AWEDT Annual average weekend daily traffic.
NA Information Not Available.

Table 5-2 Airport Study Area Vehicle Miles Traveled (VMT) for Airport-Related Traffic, 2000 - 2011					
Analysis Year	AM Peak Hour	PM Peak Hour	High 8-Hour	Average Weekday	Average Weekday Percent Change
2000 **(VMT model)**	11,213	13,252	85,823	178,798	3.0%
2001 **(VMT model)**	10,097	11,929	78,965	164,511	(8.0%)
2002**(VMT model)**	9,902	11,677	77,072	160,569	(2.4%)
2003 **(VMT model)**	9,426	11,035	74,405	155,011	(3.5%)
2004 **(VMT model)**	8,292	10,563	77,029	160,477	3.5%
2005 **(VMT model)**	8,477	10,998	80,240	167,166	4.2%
2006 **(VMT model)**	NA	NA	NA	NA	NA
2007 **(VMT model)**	9,594	12,304	88,614	184,613	10.4%
2008 **(VMT model)**	8,533	10,941	78,663	163,882	(11.2%)
2009 **(VMT model)**	8,098	10,379	74,612	155,442	(5.2%)
2010 **(VMT model)**	8,451	10,887	78,185	162,885	4.8%
2011 (VMT model)	**8,898**	**11,495**	**82,665**	**172,218**	**5.7%**
2011 (New VISSIM model)	**8,391**	**10,978**	**76,920**	**167,647**	**2.9%**

Source: VHB and Massport.
NA Information Not Available

The overall reduction in VMT since 2000 reflects the success of the Logan Airport Modernization project in reducing on-Airport roadway trip lengths by improving circulation roadways and service improvements that have increased HOV/shared-ride mode share.

Parking Conditions

Massport manages the on-Airport parking supply at Logan Airport to: (1) promote long-term rather than short-term parking (thus reducing the number of trips to Logan Airport); (2) support efficient utilization of parking facilities; (3) provide good customer service; and (4) comply with the provisions of the Logan Airport Parking Freeze. Details are presented in the following sections.

In 2011, the Logan Airport parking supply underwent significant changes. Massport completed construction of the ConRAC enabling projects of the SWSA Redevelopment Program, which eliminated various surface parking lots that were used to accommodate overflow parking. In addition, Massport completed construction of the Economy Parking Garage by adding two structured levels to the former at-grade Economy Lot in the NCA, centralizing all Economy and overflow parking in one location. Meanwhile, continued rehabilitation of the Terminal B garage and roadways caused the temporary loss of terminal-area commercial parking spaces. All of the parking supply reorganization complied with the provisions of the Logan Airport Parking Freeze.

Logan Airport Parking Freeze

The number of commercial parking spaces allowed at Logan Airport is regulated by the Logan Airport Parking Freeze (310 Code of Massachusetts Regulations 7.30), which is an element of the Massachusetts State Implementation Plan (SIP) under the Federal Clean Air Act. As required, Massport submits semi-annual filings to the Massachusetts Department of Environmental Protection (MassDEP) demonstrating Massport's compliance with the Logan Airport Parking Freeze. The reports for March and September 2011 are provided in *Appendix G, Ground Access*.

The Logan Airport Parking Freeze sets an upper limit of commercial and employee parking spaces at Logan Airport. As permitted (and encouraged) by the Parking Freeze provisions, Massport has periodically converted employee spaces to commercial spaces, within the overall limit imposed by the Parking Freeze. Table 5-3 presents the total number of parking spaces permitted on-Airport and Massport's allocation of these spaces between commercial and employee spaces.

Table 5-3 Logan Airport Parking Freeze: Allocation of Parking Spaces

	Type of Spaces		
Year	On-Airport Commercial Spaces	On-Airport Employee Spaces	Total Logan Airport Spaces Permitted
1992 - 1994	12,215	7,100	19,315
1995 - 1997	12,890	6,425	19,315
1998 - 2000	14,090	5,225	19,315
2001 - 2006	15,467	5,225	20,692[1]
2007 - 2010	17,319	3,373	20,692
2011 - 2012	18,019	2,673	20,692
2012	18,265	2,673	20,938[2]

Source: Massport.

1 In 2000, the MassDEP and EPA approved an amendment to the Logan Airport Parking Freeze to permit the transfer of 1,377 spaces originally located in the East Boston Parking Freeze Area to the Logan Airport Parking Freeze Area.

2 In July 2012, Massport acquired property at 135B Bremen in East Boston, which supported 246 park-and-fly spaces that were in the East Boston Parking Freeze inventory. Massport's elimination of those park-and-fly spaces from the East Boston Parking Freeze Area led to a revised parking freeze inventory for Logan Airport and East Boston.

Parking Supply Changes
The parking supply at Logan Airport underwent significant changes in 2011, primarily because of two major activities: the Economy Parking Garage and the ConRAC program's enabling projects. This section describes the changes and Table 5-4 provides a summary of the parking allocation.

Parking Consolidation in the North Cargo Area (NCA)
In March 2011, Massport completed construction of the Economy Parking Garage, a two-level parking deck above the former surface parking lot in the NCA. The Economy Parking Garage allowed the consolidation of roughly 2,000 commercial parking spaces from various on-Airport overflow and temporary commercial parking lots into a single structured-parking facility, for a total of about 2,800 commercial parking spaces. The garage maintains on-Airport parking capacity in compliance with the limits imposed by the Logan Airport Parking Freeze[4] (refer to Table 5-4). The parking consolidation has resulted in significant customer service improvements, eliminated many labor- and cost-intensive overflow parking management operations, and provided environmental benefits of reducing automobile and shuttle bus VMT and associated air emissions. In addition, the egress from the facility was designed and constructed to prevent exiting vehicles on Prescott Street from heading north into East Boston via Frankfort Street and Neptune Road; instead traffic is directed to Airport service roads and the primary Airport exit roadways.

Management of the parking supply continues so as to ensure strict compliance with the Parking Freeze. In addition to the benefits listed above, the Economy Parking Garage has simplified the monitoring and reporting of the Parking Freeze compliance by accommodating more vehicles in the automated parking revenue control system.

Impact of ConRAC-related Construction on Parking Supply
In 2010, Massport began construction of enabling projects for a ConRAC in the SWSA. The continued ConRAC construction has removed parking at several overflow surface lots, including Lot B in the SCA (which closed for construction of the temporary taxi pool on August 2, 2010[5]), the Old Post Office lot (Lot 4) in the SWSA (permanently closed in early May 2011), and the "Sky Chefs" overflow lot in the North Service Area. Other overflow lots that were closed include the parking lot across from Wood Island Station (which is the temporary bus/limousine pool) and a parking lot/area off Lovell Street (currently being used for construction purposes). The former Gulf Station overflow parking lot, which was temporarily closed during the reconstruction of the Hotel Drive/North Service Road intersection, has been now re-opened with automated revenue control; it is now called Terminal E, Lot 3.

Managing Parking Supply and Ensuring Compliance with the Parking Freeze
The existing supply of parking spaces at the Airport is carefully managed throughout the day, with particular attention during the week's peak-days (typically Tuesday through Thursday), to ensure compliance with the Logan Airport Parking Freeze and to efficiently manage the available supply of parking spaces on the Airport. Massport staff use several methods to monitor and manage the parking supply including the on-going tally of parking garage entrances/exits and a physical count three times each weekday (which includes an overnight count and license plate inventory). The real-time monitoring of parking use allows Massport staff to open and close facilities as necessary.

4 In 2011, a total of 700 employee spaces (first 300, then 400) were converted to commercial spaces under the Logan Airport Parking Freeze, increasing the permissible inventory of commercial spaces to 18,019 commercial and reducing the inventory of employee spaces to 2,673.
5 Since April 4, 2011, the taxi pool has been located on Lot B. Changes in traffic flow associated with the relocation of the taxi pool are reported in this chapter.

As a result, at the start of each day, the Massport staff has a clear picture of the available parking supply and what measures to take later in the day. For example, during some periods of peak demand (or when normal capacity is reduced by construction or maintenance), other surface lots may be temporarily available for use by Massport for overflow parking. The use of overflow lots is not a desired practice because it is labor-intensive and revenue control occurs separately from the pay-on-foot system. As noted earlier, the full opening of the Economy Parking Garage has eliminated much of this practice, and the availability and use of overflow lots is now substantially diminished.

Table 5-4 Logan Airport Parking Freeze: Allocation of Commercial Parking Spaces, 2011-2012

Location and Facility	Number of Spaces		Status
	March 2011	March 2012	
Terminal Area			
Central Garage and West Garage	10,375	10,344	Minor changes
Terminal B Garage	2,380	2,632	Renovations completed; back to full capacity
Terminal E Lot 1	269	269	No change
Terminal E Lot 2	257	257	No change
Terminal E Lot 3 (Former Gulf Station Lot)	229	222	Restored the temporary loss of spaces that occurred in 2010. With the subsequent conversion from an overflow lot to a Terminal E lot, a few spaces were lost with the reconfiguration and installation of revenue control equipment.
North Cargo Area (NCA)			
Economy Lot 2	n/a	n/a	Closed for construction, June 2010
Logan Airport Economy Parking Garage	2,880	2,789	Design capacity.
North Service Area			
Sky Chef Valet Lot	0	0	Eliminated for construction purposes, November 2010
Southwest Service Area			
Former U.S. Postal Service Site	416	0	Eliminated for consolidated rental car facility (ConRAC) construction, May 2011
Vacant bus/limousine pool (temporary)	250	0	Briefly vacant and available in early 2011; eliminated for construction, May 2011
Total in-service revenue commercial spaces	**17,056**	**16,513**	Excludes hotel and general aviation (GA) spaces (noted below)
Signature Flight Support (General Aviation)	35	35	No change
Hotel (Hilton, Hyatt)	505	505	No change
Total in- service commercial spaces	**17,596**	**17,053**	Includes hotel and GA spaces
Total commercial spaces (freeze limit) [1]	**17,619**	**18,019**	Includes in-service and designated spaces

Source: Massport, Parking Freeze Inventory, March 2011 and March 2012.

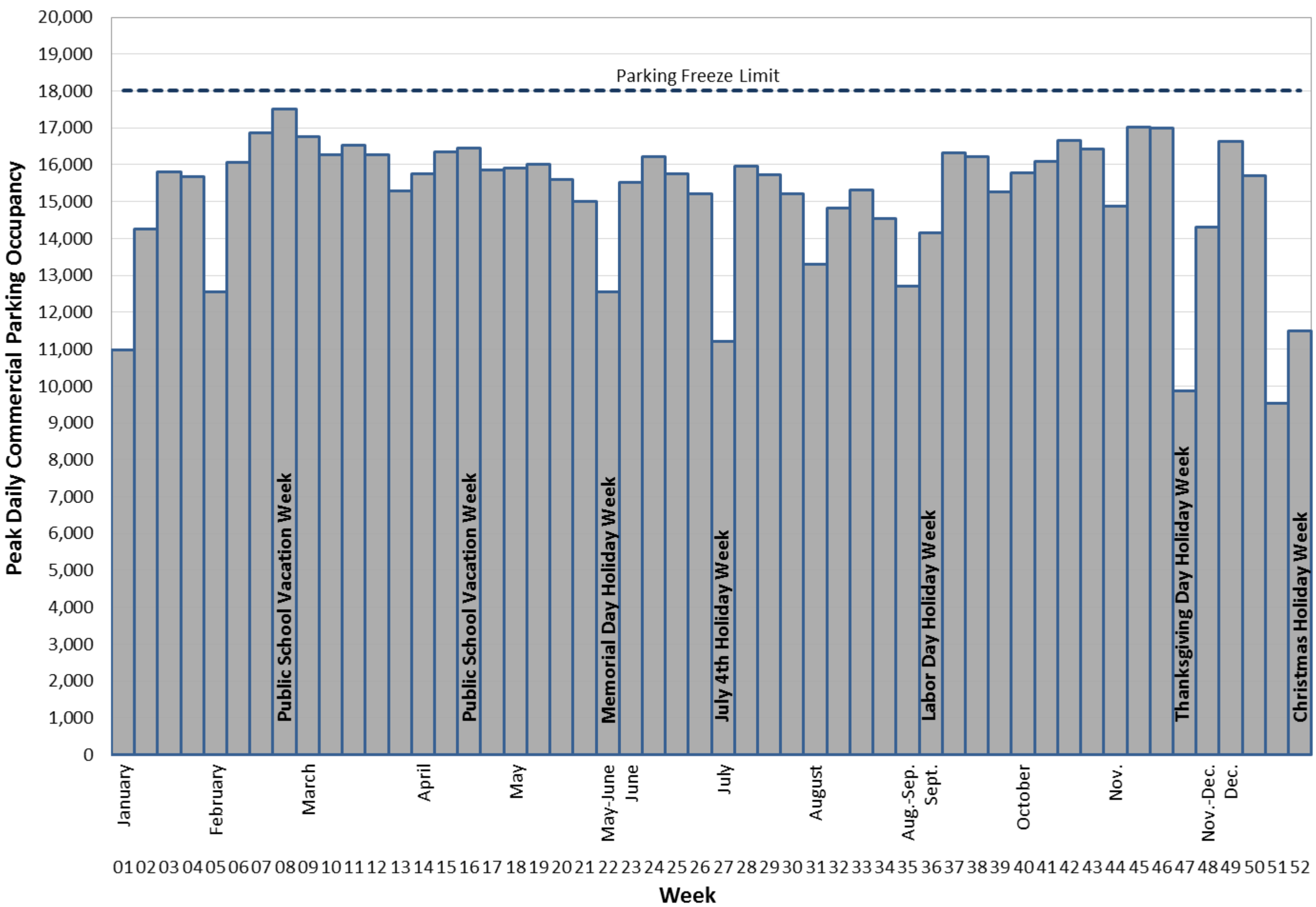
1 In 2011, a total of 700 employee spaces (first 300, then 400) were converted to commercial spaces under the Logan Airport Parking Freeze, increasing the inventory of commercial spaces to 18,019 commercial and reducing the inventory of employee spaces to 2,673.

In addition to the near-term, day-to-day management of the Logan Airport parking supply, Massport is engaged in efforts related to managing the parking supply in the long-term. Massport recognizes that these efforts must include additional or enhanced ground access services and facilities in order to handle the anticipated increase in travel (and parking) demand. Ground-access transportation strategies and initiatives are actively being explored, and are described later in the chapter.

Daily Parking Occupancy

On-Airport commercial parking occupancy typically peaks mid-week (Tuesday through Thursday) with lower occupancies occurring on other days. The number of vehicles parked at Logan Airport in commercial spaces over the course of any 24-hour period was obtained from count data for Tuesdays, Wednesdays and Thursdays throughout the year. The parking occupancy data are presented in Figure 5-2.

Figure 5-2 Commercial Parking: Peak Daily Occupancy, by Week, 2011



Source: Massport.

Note: The chart shows the highest daily count for each week in 2011.
The maximum number of commercial parking spaces permitted by the Logan Airport Parking Freeze is 18,019.
Most Massachusetts public schools had the following week-long school breaks in 2011: week 8, week 16, week 52. University breaks may differ. Columbus Day 2011 was during week 41. Thanksgiving 2011 was during week 47.

Parking Exits by Duration

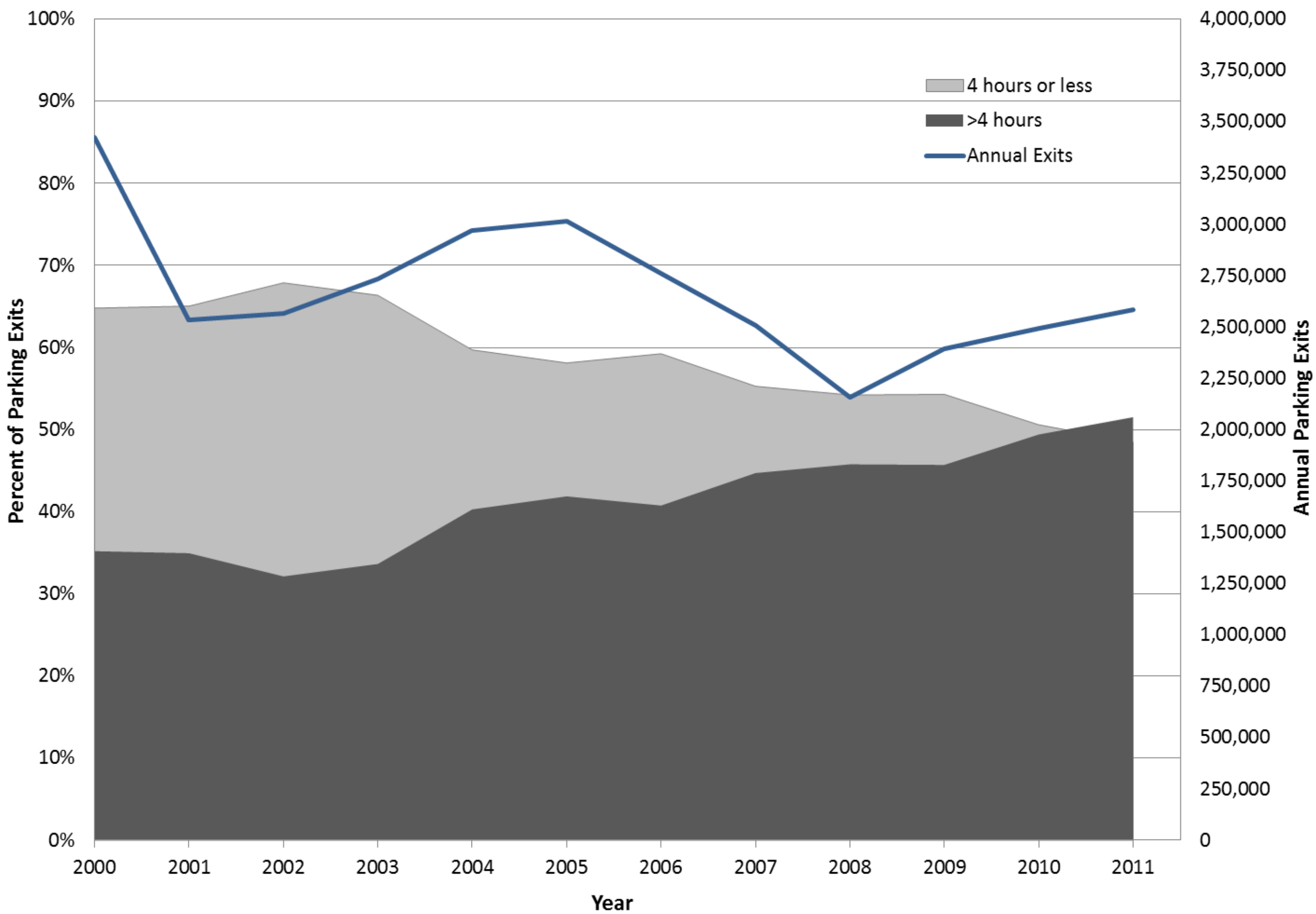
Total parking activity (as defined by revenue parking exits) increased nearly 4 percent between 2010 and 2011, as presented in Table 5-5. Notably, the distribution of parking exits by length of stay decreased for stays of up to four hours (Figure 5-3). This decrease occurred in both the number of exits in that category and as a share of all parking exits. In other words, in general vehicles were parked for longer durations during 2011. This increase in parking duration likely contributed to a lower turnover of parking spaces, and therefore resulted in the higher peak days as shown in Figure 5-2.

Table 5-5 Parking Exits by Length of Stay (Parking Duration)

		0-4 hrs.	>4-24 hrs.	>1-4 days	>4 days	Total
2000	Tickets	2,218,180	345,735	633,277	225,926	3,423,118
	Percent	65%	10%	19%	7%	
2001	Tickets	1,649,285	237,272	456,998	192,000	2,535,555
	Percent	65%	9%	18%	8%	
2002	Tickets	1,743,135	189,440	479,336	156,130	2,568,041
	Percent	68%	7%	19%	6%	
2003	Tickets	1,813,584	149,760	595,983	173,651	2,732,978
	Percent	66%	5%	22%	6%	
2004	Tickets	1,773,175	252,480	722,812	221,108	2,969,575
	Percent	59%	9%	24%	8%	
2005	Tickets	1,751,761	290,623	723,547	247,874	3,013,805
	Percent	58%	10%	24%	8%	
2006	Tickets	1,634,898	262,152	660,184	202,366	2,759,600
	Percent	59%	10%	24%	7%	
2007	Tickets	1,384,947	237,171	659,763	223,132	2,505,013
	Percent	55%	9%	26%	9%	
2008	Tickets	1,169,277	194,993	591,860	200,292	2,156,422
	Percent	54%	9%	27%	9%	
2009	Tickets	1,299,898	206,545	660,292	227,334	2,394,069
	Percent	54%	9%	28%	9%	
2010	Tickets	1,261,813	230,260	741,706	260,240	2,494,019
	Percent	51%	9%	30%	10%	
2011	**Tickets**	**1,251,956**	**235,039**	**800,188**	**295,270**	**2,582,453**
	Percent	**48%**	**9%**	**31%**	**11%**	
Percent Change (2010 to 2011)		**(0.8%)**	**2.1%**	**7.9%**	**13.5%**	**3.5%**

Source: Massport.

Figure 5-3 Percent of Parking Exits by Duration: Short vs. Long-Term Parking



Source: Massport.

2011 and 2012 Parking Rates

Massport establishes separate parking rates for the Airport's terminal area parking facilities and Economy Parking Garage, as detailed in Table 5-6. No changes to the rates were made in 2011, but new changes were made effective March 1, 2012.

Security restrictions on curbside parking and dwell times have made it necessary for Massport to establish parking rates for short-term parking to discourage curb pick-up and drop-off activity. Massport sets aside parking spaces specifically designed for this purpose and provides a free short-term parking lot known as the Cell Phone Waiting Lot (described in the next section).

With a pay-on-foot system, Massport encourages parking fees to be pre-paid at kiosks inside the terminals and garage access points at the pedestrian walkways, thus improving parking exit flow, and reducing vehicle idling and associated emissions at exit plazas. Pay stations are located in the terminals and at the pedestrian entrances to the Central Garage, Terminal B garage, and Terminal E parking lot. About 80 percent of parking patrons use the pay-on-foot system to pre-pay their parking fees.

Several off-Airport parking facilities, such as PreFlight Airport Parking in Chelsea, are privately owned and operated, and they are outside of the Logan Airport Parking Freeze area. Massport has no control over rates

at off-Airport parking lots. The parking rates for the three major off-Airport parking providers (PreFlight, Park Shuttle & Fly, and Thrifty) vary from $13.50 to $18.50 for daily parking and from $81 to $105 for weekly parking.

Table 5-6 On-Airport Parking Rates, 2011 and 2012

Location	2011 Rate	2012 Rate	Location	2011 Rate	2012 Rate
Central Parking, Terminal B Garage, Terminal E Lots		*Effective as of March 1, 2012*	**Economy Parking**		*No change*
0 to 30 minutes	$3	$3	Daily Rate	$18	$18
31 minutes to 1 hour	$6	$6	Additional days 0 to 6 hours	$9	$9
1 to 1.5 hours	$9	$9	Additional days 6 to 24 hours	$18	$18
1.5 to 2 hours	$12	$12	Weekly Rate (6-7 days)	$108	$108
2 to 3 hours	$15	$17	More than 7 Days	$108 for 7 days + $18/each additional day	
3 to 4 hours	$18	$21			
4 to 7 hours	$22	$25			
7 to 24 hours (Daily)	$24	$27			
Additional days 0 to 6 hours	$12	$14			
Additional day(s) 6 to 24 hours	$24	$27			

Source: Massport
Note: 2012 rates are effective as of March 1, 2012.

On many weeks in 2011 and 2012, vehicles were diverted from a full Central Parking Garage to available spaces at the Economy Parking Garage or the Terminal E Lot 3. This primarily occurred on Tuesdays and Wednesdays, when the peak parking demand during the day exceed the availability of spaces in the terminal area. Early indications of mid-2012 activity suggest that peak-day demand has not dampened since the March 2012 parking rate increases for on-Airport parking; however, parking demand may have decreased for non-peak days, such as Fridays and Saturdays.

Cell Phone Waiting Lot

In late 2010, the Cell Phone Waiting Lot was relocated to the intersection of Hotel Drive and North Service Road (SR-2), in an area across the roadway from the American Airlines hangar.[6] The new lot was expanded from 50 to 61 spaces.

This parking lot provides a hassle-free waiting spot for drivers waiting for passengers on arriving flights. Before the creation of the Cell Phone Waiting Lot, drivers who were waiting for arriving passengers either used the short-term parking, circulated around the Airport, or dwelled at the curb until asked to move by State Police officers. Therefore, this facility reduces vehicle emissions by minimizing idling and VMT by such motorists. The maximum wait time permitted at this parking lot is 30 minutes and parking is free of charge.

Spot observations of the original cell phone lot revealed that the peak time of day for its use is typically late afternoon/early evening when the lot could be at 70 to 100 percent capacity. During peak holiday vacation periods, the lot was observed to be at capacity more frequently.

6 The original Cell Phone Waiting Lot opened in September 2007, with 50 parking spaces in an area of Lot B located off Harborside Drive.

PASSport Gold and Parking PASSport

Parking PASSport Gold and Parking PASSport allow users to enter and exit Logan Airport's parking garages and lots with an access card that is linked to an established account for faster payment transactions. Parking fees are automatically charged to a registered credit card and the receipt is emailed to the account holder. Customers in the Parking PASSport programs account for approximately 3 to 4 percent of parking exits at Logan Airport.

Massport offers guaranteed parking through its Parking PASSport Gold program. Thereby, Parking PASSport Gold eliminates the need for a motorist to circle the garage looking for available spaces. First implemented in 2006, the Parking PASSport Gold program had 5,782 customers as of December 31, 2011, compared to 4,565 at the end of 2010. About 8 percent of spaces in the Central/West Parking garage and 12 percent of spaces in the Terminal B garage are set aside for these customers.

Hybrid/Alternative Fuel Vehicle Preferred Parking

In the State's first preferred parking program for hybrid and alternative fuel vehicles (AFVs), Massport began offering preferred parking for customers driving hybrid and AFVs in the spring of 2007. Massport provides designated parking spaces at Logan Airport's Central Garage, Terminal B Garage, Terminal E surface lot, and Economy Parking.

Pedestrian Facilities and Bicycle Parking

Massport has made substantial progress in providing Airport-wide pedestrian access. Sidewalks along Harborside Drive and Hotel Drive connect to the terminals, where a series of overhead, enclosed walkways connect to the Central and West Parking garages as well as the Hilton Hotel. The sidewalks along Harborside Drive, Transportation Way, North Service Road, Maverick Street, and the Harborwalk facilitate pedestrian access to the Airport water shuttle boat dock, MBTA station and the pedestrian and bicycle pathways at Memorial Stadium Park, Bremen Street Park, and the East Boston Greenway.

Signs at Logan Airport encourage passengers to use alternative fuel vehicles whenever possible. Source: VHB.

Bicycle parking racks are provided at many landside facilities. Generally, these racks are expected to primarily serve employees, but are open for use by air passengers as well. Terminal A, the Logan Office Center, Signature General Aviation Terminal, and Airport Station all have bicycle racks. In 2012, bicycle parking racks were also added at Terminal E, the Economy Parking Garage, and at the newly constructed Green Bus Depot. The ConRAC facility, which is under construction, will also have bicycle parking racks for both employees and passengers.

Pedestrian and bicycle safety is further enhanced through the design of streetscape, intersections, lighting, and defined vehicle zones with new curbing, crosswalks, sidewalks, plantings and fencing. Bicycle connections are available around Airport Station, Memorial Park, Bremen Street Park, and the East Boston Greenway. Connections in the SWSA are planned that will allow employees and customers of the Airport to arrive via bicycle and park in a secure covered area within the new ConRAC garage. Commuters could then utilize the unified bus system or pedestrian connections to the terminals. In the North Service Area, connections to/from Bremen Street Park and the Logan Greenway Connector are under construction. These

improvements will connect the existing shared-use path to a new, northern connector of the East Boston Greenway, which will be partially built by Massport (anticipated in 2013). Massport is also developing a Bicycle Plan for Logan Airport in order to identify the feasibility of multi-use paths and safe on-street routes for bicycle access to Airport buildings. When the study has been completed, these findings will be reported in the next *Environmental Data Report (EDR).*

Ground Access Modes: Ridership and Activity Levels in 2011

This section (1) provides an overview of transportation services available to Logan Airport users from the Boston metropolitan area, (2) reports on their 2011 ridership levels and historical trends, (3) notes the progress in meeting ground access goals, and (4) reports on Massport's cooperative planning ventures with other transportation agencies in Massachusetts.[7]

Figure 5-4 shows the distribution of ground access mode share for air passengers, as reported in the *2010 Logan Airport Air Passenger Ground Access Survey*. Logan Airport's HOV mode share is among the highest of any airport in the United States. Air passenger ground transportation modes to Logan Airport are divided into HOV/shared-ride and non-HOV/automobile categories, as follows:

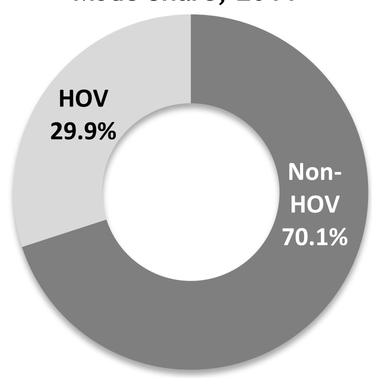
HOV (Shared-Ride) Modes:

- Public transit (Blue Line rapid transit, Silver Line bus rapid transit, bus, and water transportation)
- Logan Express scheduled bus service
- Scheduled buses and vans
- Courtesy shuttle buses
- Charter buses
- Unscheduled private limousines and vans

Non-HOV (Automobile) Modes:

- Private Autos
- Taxi
- Rental Car

Figure 5-4
Air Passenger Ground Access Mode Share, 2011



Source: 2010 Logan Airport Air Passenger Survey

HOV Mode Share Goal: 35.2%
at 37.5 million annual passengers

While private automobiles, taxis, and rental cars often carry multiple occupants, they are not currently categorized as HOV modes.[8] Please refer to the *Ground Access Planning* section later in this chapter for further discussion of the Logan Airport HOV mode share goal.

7 For additional ridership figures, please refer to *Appendix G, Ground Access*.
8 The *2010 Logan Airport Air Passenger Ground Access Survey* indicates that the average occupancy of these automobile modes (private automobiles, taxis, and rental cars) is 2.1 persons per vehicle, indicating that Massport is somewhat conservative in the calculation of HOV/SOV split. The HOV mode share goal is based on modal categories and not on actual vehicle occupancy.

HOV/Shared-Ride Modes

Annual ridership levels for HOV/shared-ride transportation modes serving Logan Airport are summarized in Table 5-7. Figure 5-5 illustrates the public transportation options to access Logan Airport. The determination of Logan Airport's mode share (the percent of air passengers using a particular mode to access Logan Airport) is based on the results of a triennial air passenger survey.[9] The *2010 Logan Airport Air Passenger Ground Access Survey*[10] revealed a 29.9 percent HOV ground access mode share, up from 27.8 percent identified in the *2007 Logan Airport Air Passenger Ground Access Survey*. The *2010 Air Passenger Ground Access Survey* is discussed in further detail later in this chapter.

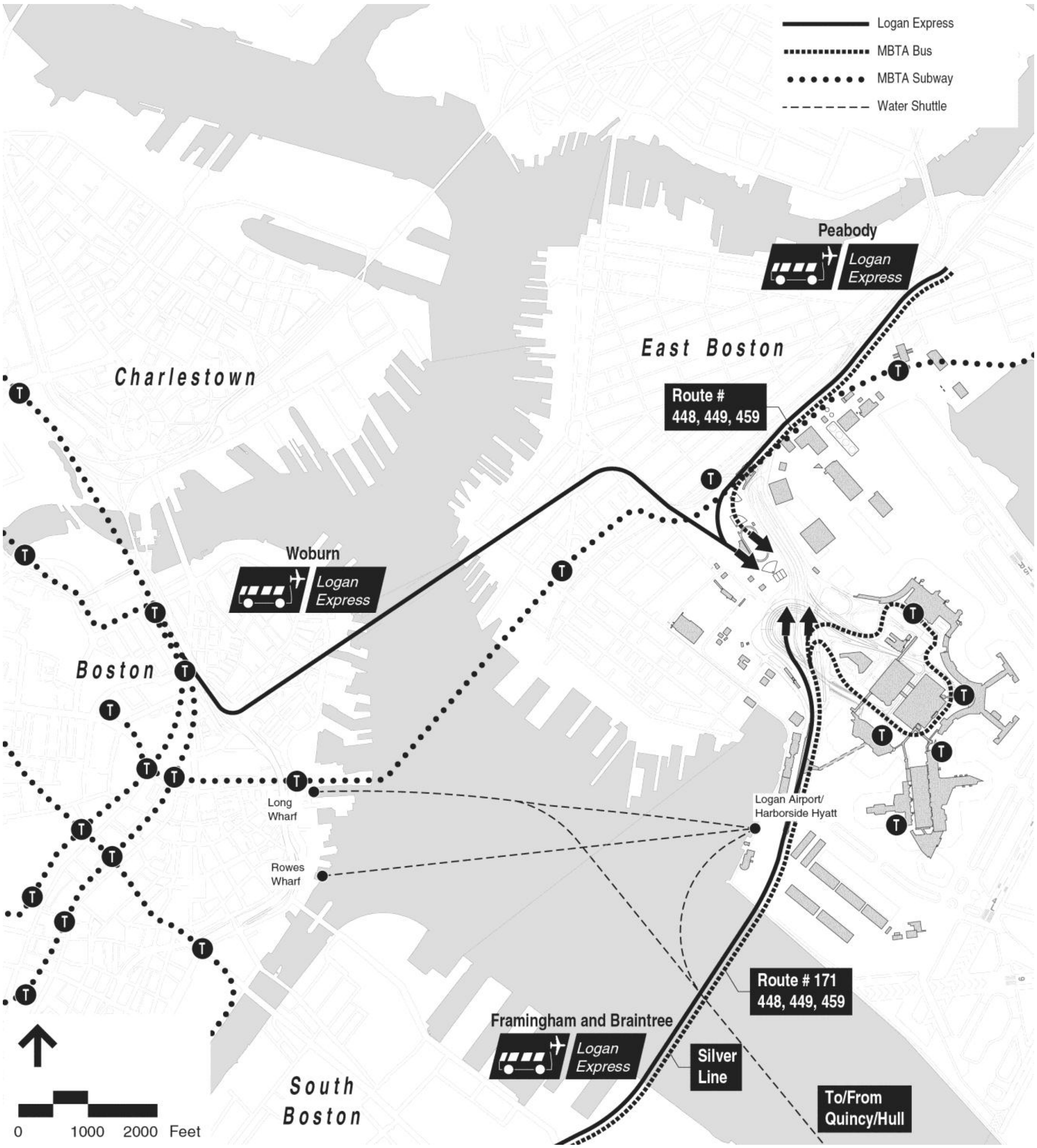
Table 5-7 Annual Ridership and Activity Levels on HOV/Shared-Ride Modes, 2000 - 2011

	MBTA Transit		Logan Express Bus			Water Transportation[3]			Scheduled and Unscheduled HOV	
Year	Blue Line[1]	Silver Line[2]	Air Passen-gers	Employ-ees	Total	MBTA Ferry[3]	Private Water Taxis	Rowes Wharf / Fan Pier Water Shuttle	Shared-Ride Vans/ Buses[4]	Limousine[5]
2000	1,518,789	NS	923,236	211,717	1,134,953	83,243	26,335	128,097	1,123,215	1,791,772
2001	1,457,190	NS	885,296	236,395	1,121,691	82,704	29,642	107,400	899,113	1,061,292
2002	1,343,475	NS	855,632	326,707	1,182,339	66,471	36,736	75,304	675,200	1,127,666
2003	1,300,272	NS	808,335	400,132	1,208,467	61,849	35,724	26,480	705,237	1,373,517
2004	1,375,632	NS	857,530	408,297	1,265,827	58,788	54,540	NS	761,320	1,448,581
2005	NA	254,608	837,530	397,660	1,235,190	51,960	44,975	NS	701,500	1,250,180
2006	NA	642,177	891,918	418,051	1,309,969	70,998	63,639	NS	775,640	1,591,361
2007	1,406,834	677,212	797,530	404,222	1,201,752	59,460	50,737	NS	NA	1,448,060
2008	2,212,111	709,905	688,673	432,761	1,121,434	48,003	48,630	NS	NA	1,385,317
2009	2,329,370	789,324	636,847	448,601	1,085,448	37,861	50,734	NS	NA	1,227,096
2010	2,270,241	831,323	644,412	467,020	1,111,432	34,794	54,382	NS	NA	1,426,316
2011	**2,277,311**	**900,359**	**649,609**	**536,513**	**1,186,122**	**33,403**	**58,879**	**NS**	**NA**	**1,568,618**
Percent Change (2010-11)	**0%**	**8%**	**1%**	**15%**	**7%**	**-4%**	**8%**	**NA**	**NA**	**10%**

Source: Massport
Notes:
NA Ridership numbers are not available.
NS Operation was not in service.
1 Airport Station fare gate entrances only. Automatic Fare Collection introduced in January 2007. The Bremen Street Park entrance to MBTA Airport Station opened June 2007; station activity is not limited to only Airport-related passengers.
2 Boardings at Logan Airport. SL1 service began June 1, 2005; ridership for 2005 is for the seven-month period only.
3 MBTA Ferry is the Harbor Express F2/F2H service, Quincy/Hull-Logan and Long Wharf. Private water taxis includes: City Water Taxi, Rowes Wharf Water Transport, and Boston Harbor Water Taxi; excludes Boston-Logan Water Shuttle (cancelled mid-2004). Rowes Wharf / Fan Pier Water Shuttle operated until June of 2003.
In 2005, available water transportation services decreased from four companies to two. Also in 2005, the final CA/T connections to the TWT were completed and opened to traffic.
4 Includes outbound passengers only on services offered by bus or van lines and hotels on a pre-determined schedule and route. Recent figures are not available.
5 Limousines include outbound passengers only; estimates are based on limousine dispatches and an established average vehicle occupancy based on *2010 Logan Airport Air Passenger Ground Access Survey* responses.

9 While the ridership information presented in this *2011 ESPR* provides a status report on 2010 conditions, it cannot be used to determine mode shares for individual modes or for passengers or employees separately because the data do not discern between air passengers or employees. Moreover, non-Airport patrons, such as East Boston residents and car rental patrons, can be included in the ridership data.
10 To better understand the ground access travel characteristics of air passengers to and from Logan Airport and to track historical trends of these characteristics, Massport administers a periodic (typically every three years) extensive survey of air passengers. The air passenger ground access survey is the principal means of measuring air passenger HOV mode share.

Figure 5-5 Logan Airport - Public Transportation Options



Rapid Transit

The MBTA provides direct connections to Logan Airport via the Blue Line at Airport Station and via the Silver Line to each of the terminals. According to the *2010 Logan Airport Air Passenger Ground Access Survey,* these services are used by over 7 percent of Logan Airport's air passengers. (Almost 17 percent of passengers with trip origins in Boston, Cambridge, Brookline and Somerville used MBTA public transit to travel to the Airport.) Both services are important for reducing automobile travel to the Airport: according to the survey, the majority of users of the Blue Line and Silver Line indicated that their alternative mode of travel to Logan Airport would have been a taxi or they would have been dropped off at the Airport by private vehicle.

Blue Line Ridership

Fare gate data indicate that 2.27 million riders entered Airport Station in 2011. Since fare gate data do not distinguish between Airport related riders and East Boston users, Airport passenger ridership levels on the Blue Line can no longer be directly identified as part of the ESPR/EDR reporting.[11] The increase in ridership at Airport Station can be attributed to the opening of the Bremen Street Park entrance to the station in 2007.

The Blue Line Airport Station (picture left) entrance and the Silver Line bus rapid transit at Logan Airport (picture right). Source: Massport.

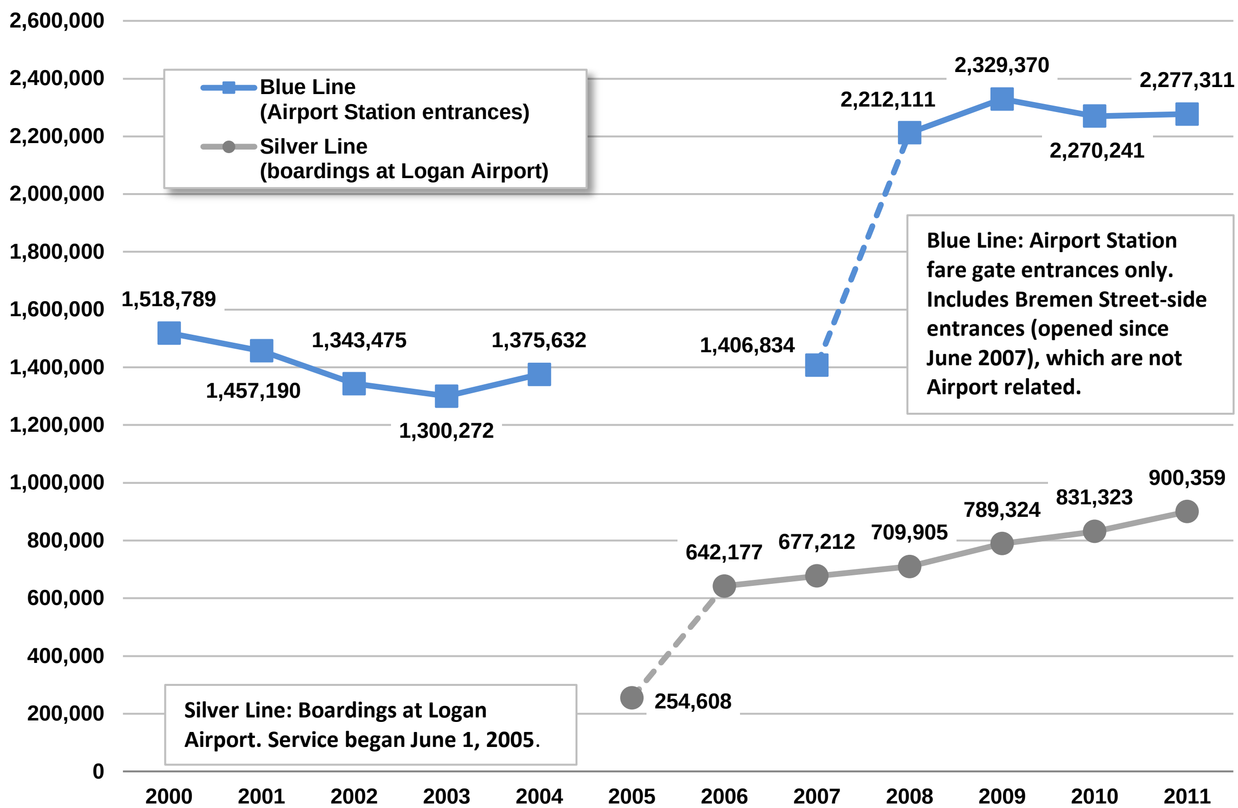
Silver Line Ridership

The Silver Line bus rapid transit service to Logan Airport provides a direct connection between South Station and the Airport terminals via the South Boston Transitway and the TWT. In 2011, a record 900,000 passengers boarded the Silver Line at Logan Airport. Silver Line Airport buses (SL1) are owned by Massport and are operated by the MBTA with a Massport subsidy. The Silver Line is the only MBTA rapid transit service that provides a direct, one-seat connection to each Airport terminal. (The Blue Line requires a second-seat ride on a free Massport shuttle to connect riders to terminals, while express transit buses connect only at Terminal C, and local bus service to the Airport is very limited.) Transfers between the Silver Line and the Red Line at South Station are free. At South Station, passengers may also connect to the MBTA commuter rail, Amtrak, and regional intercity buses.

As shown in Table 5-7 and Figure 5-6, Silver Line ridership to/from the Airport continues to increase; ridership has increased every year since full inception of the service in June 2005.

11 Based on automated fare gate entrance counts, approximately 50 percent of entrances occur via the Bremen Street Park fare gates at Airport Station. Based on Massport curbside observations, approximately 45 percent of Airport Station entrances are by airport users.

Figure 5-6 Annual MBTA Boardings at Logan Airport: Blue Line and Silver Line



Note: Blue Line ridership data were not available for 2005 and 2006. In 2007, new fare gate equipment was installed to allow for more reliable ridership data collection.

Logan Express Bus Service

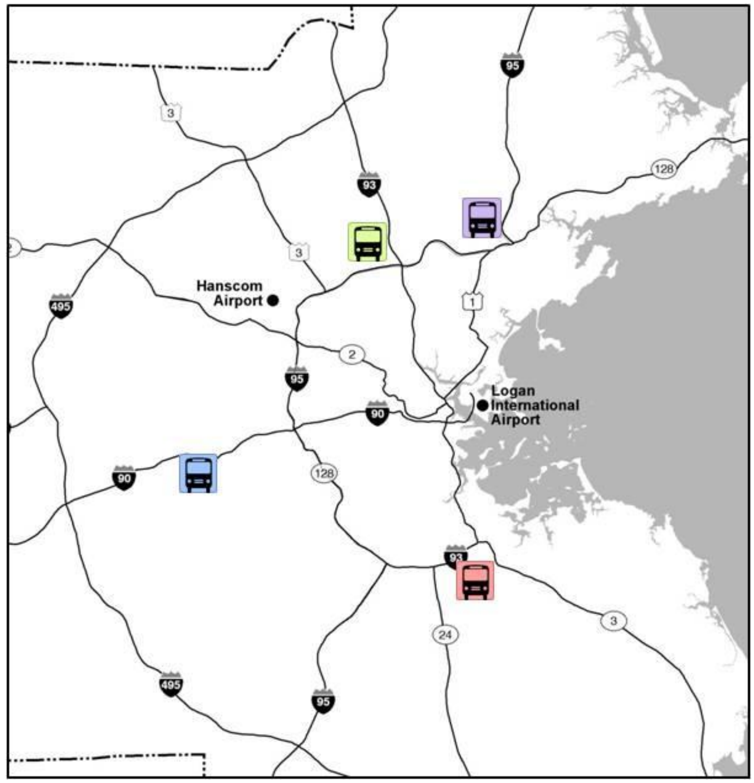
Massport provides frequent, scheduled, express bus service to Logan Airport for air passengers and Logan Airport employees from park-and-ride lots in Braintree, Framingham, Woburn, and Peabody. Full service bus terminals and secure parking are provided at all four locations.

The round-trip adult fare is $22; reduced fares are offered to seniors and children under the age of 12 ride free with an adult. To encourage greater ridership, a parking rate restructuring went into effect on March 1, 2012, which lowered parking rates to $7 per day from $11 per day at Logan Express parking lots.

A Logan Express bus on an Airport roadway. Source: Massport.

On weekdays and Sunday afternoons/evenings, scheduled half-hour headways are provided between the Braintree, Woburn, and Framingham locations and Logan Airport; one-hour headways are provided at these locations on Saturdays and Sunday mornings. In September 2009, the scheduled bus service to/from Peabody changed in response to low ridership and is now provided hourly on weekdays and every 1.5 hours during the weekend. Service hours for all four locations are roughly 3:15 AM to midnight.

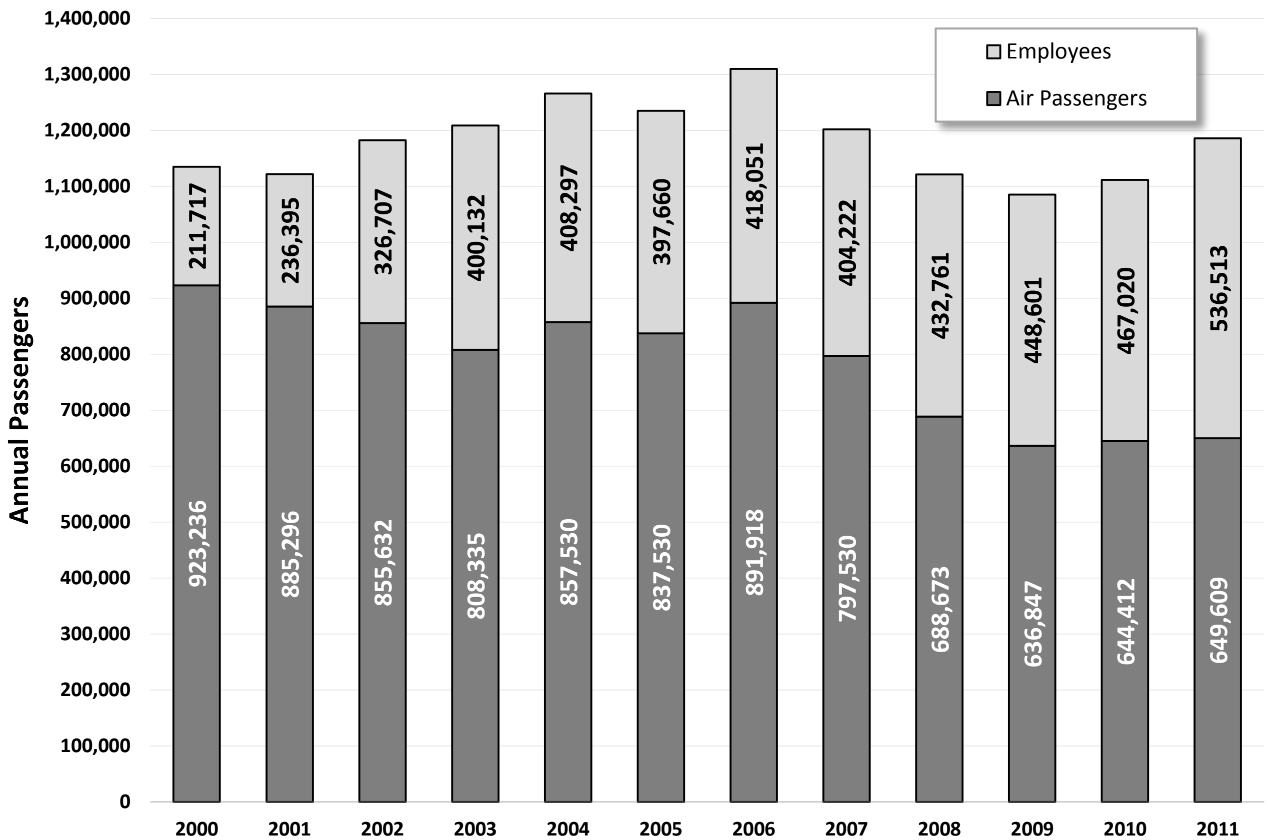
In the fall of 2011, two changes in the Logan Express system had a positive effect on use of the service for both air passengers and Airport employees. The first change took place in October with the addition of early morning buses from the Logan Express terminals and the addition of buses after midnight departing from Logan Airport. These buses primarily have drawn passengers from the airline employees, but a significant number of air travelers ride these buses as well. In addition to extra bus service, Massport introduced a monthly pass for airline employees, which reduced the cost of parking and riding the bus from $140 to $100. The cost of a 44-ride employee pass remains unchanged at $75, but the separately purchased monthly Logan Express parking pass was reduced from $65 to $40. Logan Airport employees have responded positively to these pricing incentives.



Logan Express Bus Terminals and Park-and-Ride Lots. Source: Massport.

Recent annual ridership trends for Logan Express are shown on Figure 5-7 and Table 5-7. Air passenger ridership on Logan Express increased about 1 percent from 2010 to 2011, while employee ridership increased 15 percent. A detailed breakdown of the Logan Express ridership is presented in *Appendix G, Ground Access*. Logan Express is used by about 4 percent of Logan Airport's air passengers, according to the *2010 Logan Airport Air Passenger Ground Access Survey*.

Figure 5-7 Logan Express Bus Annual Ridership, 2000 - 2011



Note: In 2006, the TWT was fully and partially closed for inspections and repairs, which led to many travelers pursuing alternative modes of travel to Logan Airport, including Logan Express.

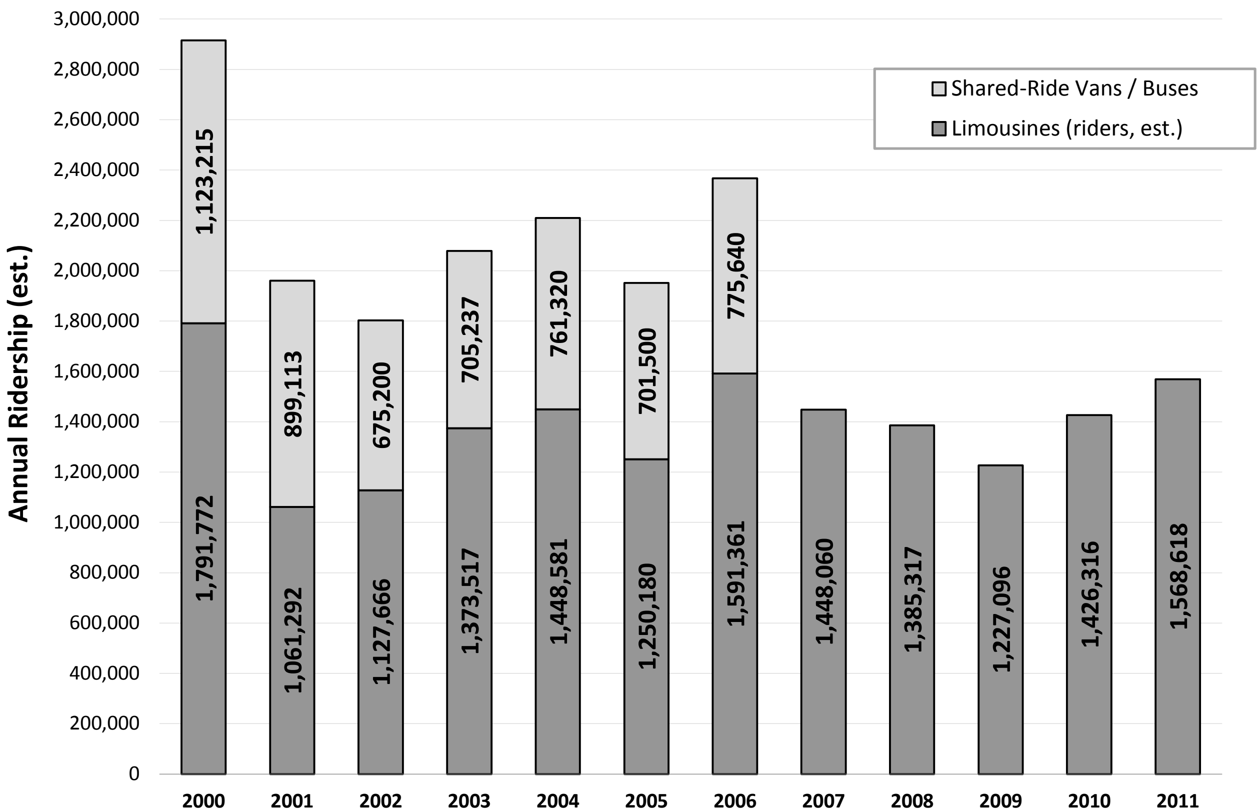
Scheduled Buses, Shared-Ride Vans, and Limousines

Massport provides designated curb areas at all Airport terminals to support the use of HOV modes, including privately-operated scheduled buses and shared-ride vans and limousine services. About 15 percent of air passengers use these shared-ride services to arrive at Logan Airport based on the *2010 Logan Airport Air Passenger Ground Access Survey*.

The majority of scheduled shared-ride carriers use a combination of 15- to 40-passenger vehicles and 40+ passenger coach buses. Scheduled express bus service is offered by several privately-operated carriers from outlying areas of the Boston metropolitan area and neighboring states. Shared-ride van services include services between Logan Airport and many hotels in the Greater Boston area. Shared-ride vans also provide service from western Massachusetts and other regional points throughout New England. As shown in Table 5-7 and Figure 5-8, the use of limousines increased by approximately 10 percent in 2011.

Massport offers a 50 percent discount on the ground access fees for alternative fuel vehicles that use compressed natural gas (CNG) or are powered by electricity.

Figure 5-8 Shared-Ride Bus, Van and Limousine Annual Ridership/Activity[1]



1 Shared-ride bus/van ridership reporting is voluntary; due to incomplete figures reported to Massport, these numbers are no longer reported for the scheduled shared-ride services table/graph. Limousines riders include outbound passengers only; ridership estimate is based on limousine dispatches and an established average vehicle occupancy.

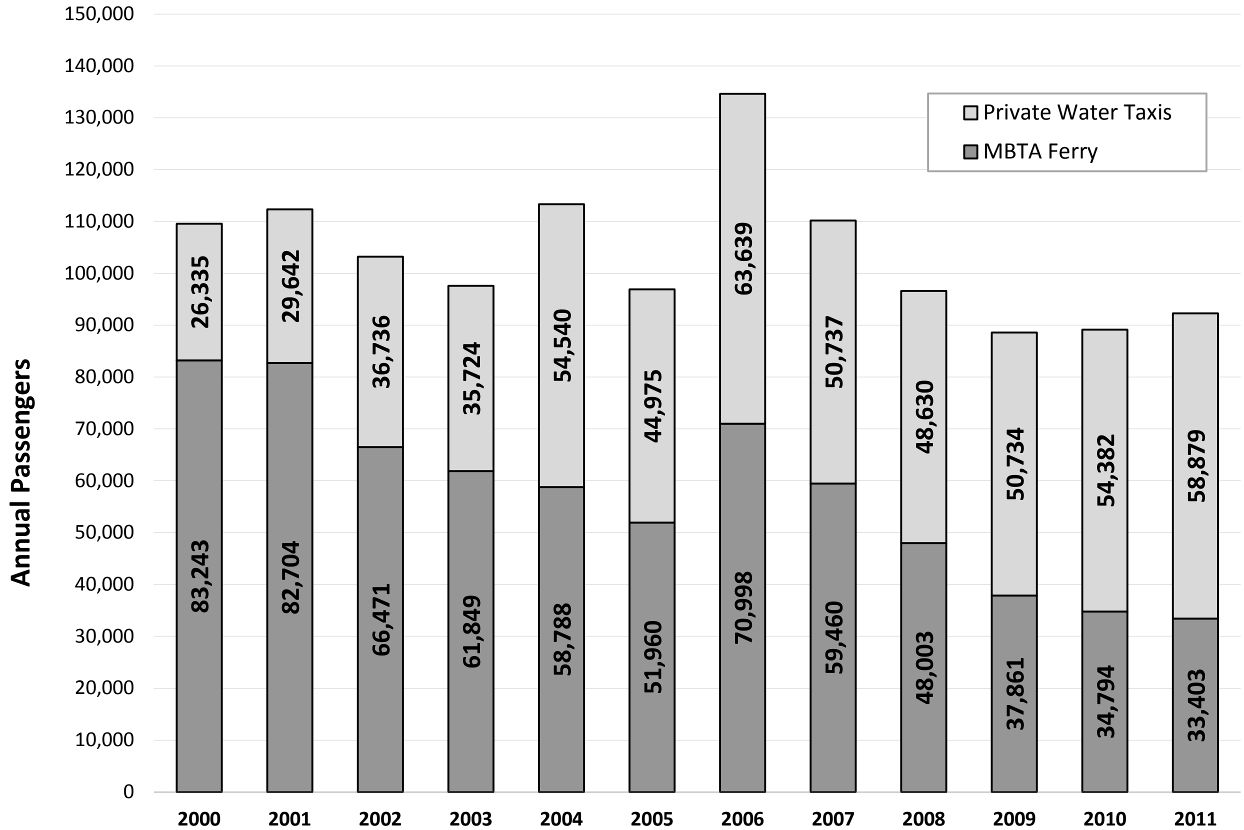
Water Transportation: Water Taxis and Ferries

Three companies provide water transportation within the Boston area: City Water Taxi, Rowes Wharf Water Shuttle, and the MBTA's Harbor Express. Collectively, these companies serve numerous destinations throughout Boston Inner Harbor. The water taxi landing locations include: Long, Rowes, and Central Wharfs; the World Trade Center and the Moakley Courthouse in South Boston; Lovejoy Wharf near North Station; and stops in the North End, Charlestown, Chelsea, and East Boston. The MBTA Harbor Express provides services to Long Wharf and destinations outside of the Inner Harbor, including Quincy and Hull. [12] The water transportation services stop at the Logan Airport dock on Harborside Drive. Massport provides a courtesy shuttle bus service between the Logan Airport dock, the MBTA Airport Station, and all Airport terminals.

Water transportation accounts for less than 1 percent of the mode share to Logan Airport, according to the *2010 Logan Airport Air Passenger Ground Access Survey*. Annual ridership on water transportation experienced an increase of over 3 percent in 2011 compared to 2010, as shown in Figure 5-9.

12 The MBTA ferry schedule from Quincy/Hull to the Logan Ferry Dock is not as frequent as Blue Line and Silver Line services, and does not run on frequent and consistent headways throughout the day. Headways between ferries on weekdays range from 20 minutes to 1 hour 20 minutes, or on weekends from 1.5 hours to 2.5 hours. There are 20 MBTA ferries to Logan Airport on weekdays, however there are no MBTA ferries direct to Logan from the South Shore during morning commuting times. The one-way fare to cross the Boston Harbor from Long Wharf to Logan Airport costs $10, and $12 from Quincy/Hull (twice the regular fare to Boston).

Figure 5-9 Water Transportation Annual Ridership, 2000 - 2011



Note: In 2005, available water transportation services decreased from four companies to two. In 2006, the TWT was intermittently closed for inspections and repairs, which diverted many travelers to alternative modes of travel to Logan Airport.

Non-HOV (Automobile) Modes

Logan Airport passengers can access the Airport by a number of automobile modes, including private automobiles, taxis, and rental cars. These modes account for about 70 percent of the access modes used by air passengers, based on the *2010 Logan Airport Air Passenger Ground Access Survey*, down 2 percent from the 2007 survey. Although these modes are categorized as non-HOV, they frequently carry more than one passenger per vehicle. Based on the 2010 survey results, the average vehicle occupancy for these automobile modes is estimated at 2.1 passengers per vehicle.

Automobile Access

Private automobile access to the Airport is classified as either curbside drop-off, or parked on-Airport (terminal area or remote/Economy). Traffic conditions associated with these trips are described in the previous section on traffic conditions.

Rental Car

Currently, nine rental car brands serve Logan Airport. Seven (Alamo, Avis, Budget, Dollar, Enterprise, Hertz, and National) are located on-Airport in the SWSA. The two rental car brands that operate from sites on Route 1A north of the Airport (Advantage, Thrifty) will relocate onto the Airport into the ConRAC facility currently under construction in the SWSA.

Each rental car brand operates its own diesel-fueled shuttle bus fleet that runs between all terminals and their respective on or off-Airport facilities. The SWSA Redevelopment project will eliminate the existing diesel-fueled RAC bus fleet, and those passengers will be served by Massport's new clean diesel-electric hybrid and CNG fleet serving all terminals, the ConRAC, and Airport Station.

The results from the *2010 Logan Airport Air Passenger Ground Access Survey* indicate that approximately 11 percent of air passengers used rental cars to access the Airport.

Taxis

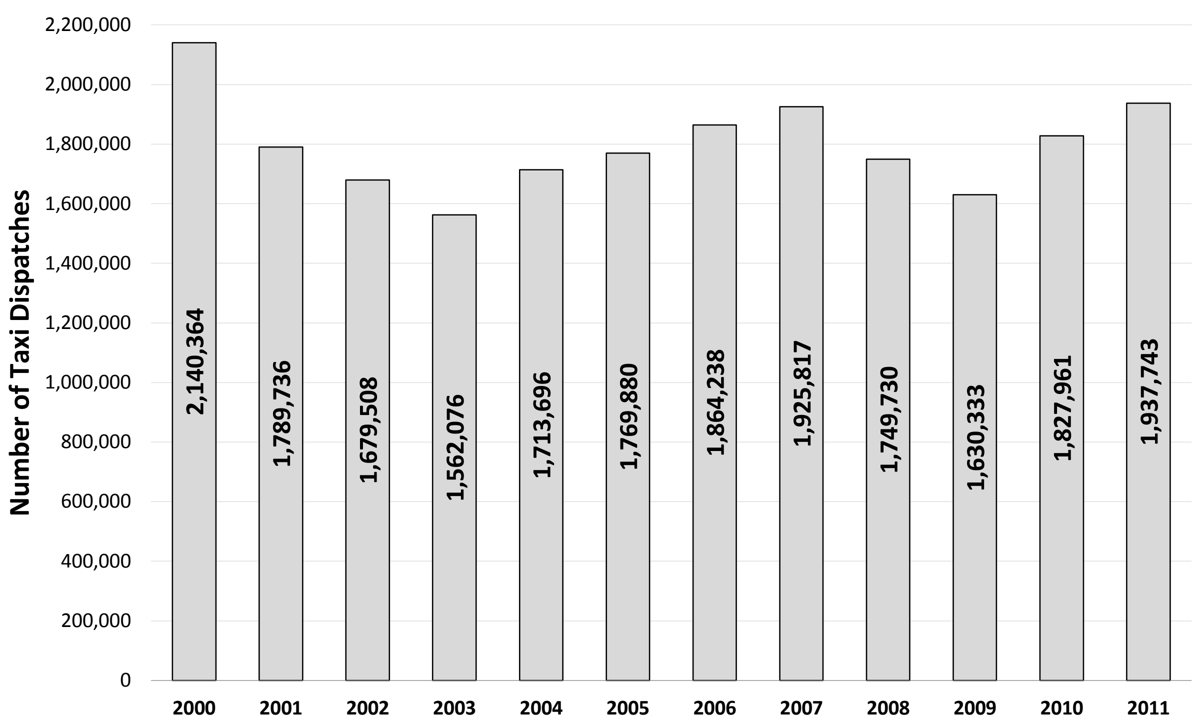
Taxi ridership trends are reflected in the total number of taxis dispatched from Logan Airport (serving outbound passengers). As shown in Figure 5-10, the total number of taxis dispatched rose in 2011 by 6 percent over the 2010 level. Taxi dispatches reflect the increase in air passenger levels. Nevertheless, taxi use remains below the highest recorded level (2.14 million dispatches in 2000 when Logan Airport served 27.7 million annual air passengers).

The *2010 Air Passenger Ground Access Survey* found that approximately 19 percent of air passengers accessed the Airport via taxi, which is similar to the numbers from the 2007 survey. Taxi vehicle occupancy is approximately 1.9 passengers per vehicle according to the *2010 Air Passenger Ground Access Survey*.

Green Cab Program

Since 2007, Massport has sponsored a "Head-of-Line" hybrid vehicle taxi incentive program, in partnership with the City of Boston. Under this program Boston taxis that qualify as a clean-fuel vehicle may obtain permission to proceed to the short job lane at Logan Airport's taxi pool; this allows these "green cabs" to be dispatched to the terminals in a shorter amount of time.

Figure 5-10 Annual Taxi Dispatches



Note: The available taxi data only reports dispatches from Logan Airport's taxi pool. The data do not include suburban or city taxis that drop passengers at Logan Airport and depart empty, as these companies are not required to provide their ridership statistics to Massport.

Logan Airport Air Passenger Ground Access Survey

Massport periodically administers an extensive survey of air passengers in order to better understand the ground access travel characteristics of air passengers to and from Logan Airport and to track historical trends of these characteristics. Since the late 1970s, the *Logan Airport Air Passenger Ground Access Survey* has been Massport's primary tool for understanding the changes in ground access patterns and the effectiveness of its policies and services. The survey is also used to shape the direction of ongoing and new Massport planning efforts to encourage Logan Airport travelers to use HOV/shared-ride modes instead automobile modes. The survey is the principal means of measuring air passenger HOV mode share. Since the *2004 ESPR*, a survey was administered in 2007 and again in 2010. (A new survey is planned for the spring of 2013.)

Results of the *2010 Logan Airport Air Passenger Ground Access Survey* that relate to mode share are presented in this section. For a more complete summary, please refer to the *2010 EDR* or to the final report of the survey, available on Massport's website.[13] This section also compares the 2010 passenger survey findings to those of previous surveys.

Ground Access Modes of Travel

As discussed previously, air passengers traveling to and from Logan Airport have several ground access modes available to them, which are often categorized as follows:

- Private Automobile: Includes all passengers that are dropped-off by a privately-owned automobile, and all passengers who drive and park their vehicles at the Airport.
- Taxi: A passenger driven to Logan Airport in a licensed, commercial taxi.
- Rental Car: A passenger who rents a car from an on-Airport or nearby off-Airport rental car agency.
- Scheduled HOV Service: A passenger who arrives at Logan Airport via scheduled bus or limousine or van service, including privately-operated services and Massport's Logan Express.
- Unscheduled HOV Service: Includes passengers who travel to Logan Airport via unscheduled limousine or van carriers.
- Transit: A passenger who takes an MBTA public transit service (including the Blue Line subway, Silver Line bus rapid transit) or one of the water transportation services (operated in conjunction with a dedicated Massport shuttle bus to/from Logan Airport terminals).
- Courtesy Shuttle: A passenger who arrives at the Airport in a courtesy shuttle, such as those offered by nearby hotels.
- Other: Includes passengers that access the Airport by walking, riding a bicycle, or taking a charter bus.

Table 5-8 presents these aggregated air passenger ground access mode shares for survey years 1999 through 2010. As the data indicate, the overall HOV mode share for air passengers has fluctuated around the 30 percent mark in each of the survey years during this time period. Thus, even with air passenger growth, the HOV-Automobile mode share split has remained relatively stable.

13 Massport. Logan Airport Air Passenger Ground-Access Survey. www.massport.com/environment/environmental_reporting/Pages/LoganAirportAirPassengerGround-AccessSurvey.aspx.

Table 5-8 Ground Access Mode Share (All Passengers) by Survey Year				
Ground Access Mode	**1999**	**2004**	**2007**	**2010**
Non-HOV/Automobile				
Private Automobile	36.5%	36.0%	40.2%	40.4%
Taxi	20.6%	22.8%	19.7%	18.8%
Rental car	12.2%	10.9%	12.4%	10.9%
Total Non-HOV Share	**69.3%**	**69.7%**	**72.3%**	**70.1%**
HOV/Shared-Ride				
Unscheduled HOV	8.9%	8.1%	7.3%	7.6%
Scheduled HOV	9.5%	10.6%	6.9%	8.2%
Transit	9.7%	6.5%	6.7%	7.6%
Courtesy Shuttle	2.1%	3.1%	3.5%	4.6%
Other	0.5%	2.0%	3.4%	1.8%
Total HOV Share	**30.7%**	**30.3%**	**27.8%**	**29.9%**

Source: Spring 1999, 2004, 2007, and 2010 Air Passenger Ground Access Surveys.

Average Vehicle Occupancy (Air Passengers) by Ground Access Vehicle Modes

Table 5-9 presents estimates of average vehicle occupancy and the share of ground-access trips made by single-occupant vehicles by various ground access modes (transit modes and charter buses are excluded). These estimates are made using the responses provided in the *2010 Logan Airport Air Passenger Ground-Access Survey*. The average occupancy for automobile vehicle modes is about 2.1 passengers per vehicle, while the average occupancy for the shared-ride vehicle modes is about 3.9 passengers per vehicle. In other words, trips made by private automobile often carry more than one passenger per vehicle.

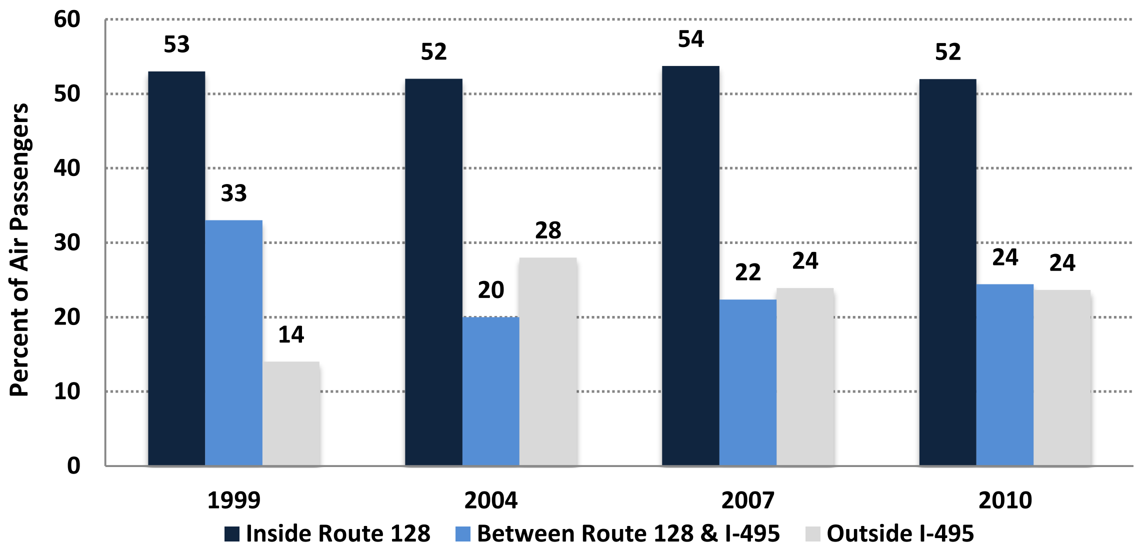
Table 5-9 Average Vehicle Occupancy by Ground Access Mode (2007 and 2010, weekday)		
Mode	**2007 Vehicle Occupancy**	**2010 Vehicle Occupancy**
Private Vehicle	2.4	2.3
Taxi	1.7	1.9
Rental Vehicle	2.0	2.2
Subtotal for Automobile Modes	**2.1**	**2.1**
Van or Limousine by Reservation	2.2	2.9
Courtesy Shuttle	4.8	6.7
Van or Limousine Running on Fixed Schedule	3.5	4.4
Subtotal for the Above Shared-Ride Vehicle Modes	**2.9**	**3.9**

Source: Massport, 2007 and 2010 Logan Airport Air Passenger Ground-Access Surveys.
Note: The true average occupancy per vehicle arriving at the Airport cannot be computed from the responses to the survey because it is not possible to identify multiple travel parties arriving in a single vehicle. Average occupancy in this table was calculated as the average occupancy of arriving vehicles across survey respondents.
An SOV passenger is defined as an air passenger that arrives at the Airport with no other air passengers in the vehicle. Air passengers can arrive as the only traveling air passenger in any of the above modes; thus, drivers and/or occupants who are not traveling are excluded from the occupancy calculation.

Ground Access Origins of Air Passengers

Figure 5-11 indicates how the distribution of air passenger trips by geographic area has changed since 1999. The majority of trips still originate in Boston and other communities within Route 128. Nevertheless, Logan Airport draws nearly a quarter of its passengers from areas outside of Route 128/I-495.

Figure 5-11 Logan Airport Air Passenger Ground Access Trip Origins



Source: Spring 1999, 2004, 2007, and 2010 Logan Airport Air Passenger Ground Access Surveys.
Note: Based on air passengers departing on both weekdays and weekend days.

Market Segment: Trip Purpose and Residency

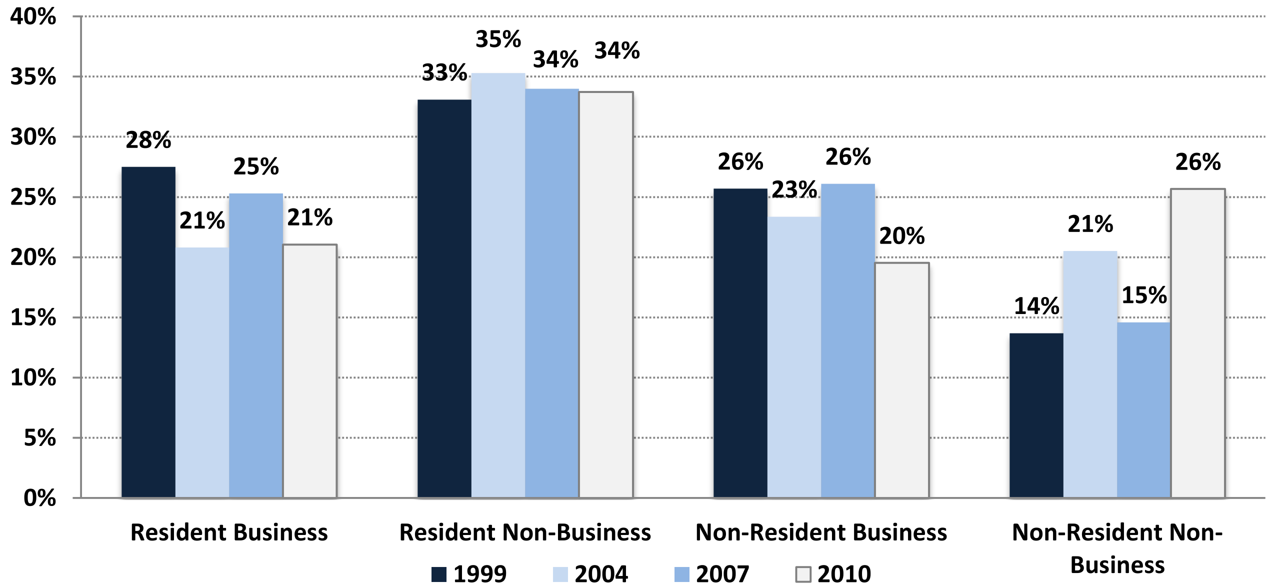
Massport characterizes air passengers into four distinct market segments:

- Resident Business: passengers living within the region served by Logan Airport and traveling for business reasons.
- Resident Non-Business: passengers living within the region served by Logan Airport and conducting personal travel (e.g., leisure trip).
- Non-Resident Business: passengers living outside the region served by Logan Airport and traveling to conduct business.
- Non-Resident Non-Business: passengers living outside the region served by Logan Airport and traveling for personal reasons (e.g., leisure or vacation travelers).

Residents are defined as passengers who use Logan Airport as their "home" airport, regardless of their proximity to other airports. It is important to study the passenger market in this manner because sensitivity to key factors that influence travel behavior such as convenience, time reliability, and pricing varies substantially among these passenger market segments. This information assists Massport in developing appropriate ground access services for passengers.

Figure 5-12 compares the share of weekday trips by market segment across four recent surveys. The resident non-business market is the largest market segment, contributing about one-third of all air passengers at Logan Airport. The market share of this segment remained roughly flat between 2007 and 2010. The percentage of non-resident non-business trips increased to about a 25 percent share of weekday travel, compared to about 15 percent in 2007. Since 2004, non-resident non-business travelers have almost doubled from 14 percent to 25 percent possibly due to the availability of low cost carrier service at Logan Airport, which has attracted air passengers from beyond the Airport's core market area.

Figure 5-12 Weekday Market Segments (Combined Trip Purpose and Residency)[1]



Source: Spring 1999, 2004, 2007, and 2010 Logan Airport Air Passenger Ground Access Surveys.
1 Based on air passengers departing on weekdays only. Figures rounded.

Table 5-10 presents mode shares by market segment. HOV mode share is lower among the business segments compared to the non-business segments. Business travelers typically have low HOV mode share because they have high sensitivity to time, require flexibility and schedule reliability, and often make decisions related more to convenience than to cost, which is often covered by their employer not by the passenger. The non-resident business market segment continues to choose taxis and rental cars as their primary ground access mode to Logan Airport and the resident business travelers are strongly private automobile users, with a strong preference for parking at the Airport. Public transit and scheduled HOV services (including Logan Express) have a higher share among the non-business market segments. Non-business market segments are more sensitive to ground transportation costs, travel less frequently but for longer time periods, and tend to travel at off-peak fly times/days.

Table 5-10 Ground Access Mode Share by Market Segment (All Passengers)

Ground Access Mode	Resident Business 1999	2004	2007	2010	Non-Resident Business 1999	2004	2007	2010
Automobile Modes	**74%**	**74%**	**74%**	**75.6%**	**74%**	**72%**	**76%**	**74.7%**
Private Automobile	50%	54%	54%	58.7%	9%	18%	12%	11.7%
Taxi	23%	19%	18%	16.2%	31%	30%	35%	36.1%
Rental Car	1%	1%	2%	0.6%	34%	24%	29%	26.8%
HOV Modes	**26%**	**26%**	**26%**	**24.4%**	**26%**	**28%**	**24%**	**25.3%**
Unscheduled HOV	12%	11%	13%	10.3%	6%	7%	8%	10.2%
Scheduled HOV	9%	8%	6%	6.1%	8%	7%	3%	3.0%
Transit	5%	5%	6%	4.4%	8%	6%	6%	5.0%
Courtesy shuttle	<1%	1%	<1%	2.3%	4%	7%	5%	4.7%
Other	<1%	1%	1%	1.2%	<1%	1%	2%	2.4%

Ground Access Mode	Resident Non-Business 1999	2004	2007	2010	Non-Resident Non-Business 1999	2004	2007	2010
Automobile Modes	**62%**	**68%**	**67%**	**63.1%**	**71%**	**70%**	**73%**	**70.8%**
Private Automobile	46%	49%	51%	48.7%	35%	38%	36%	35.9%
Taxi	15%	16%	14%	12.5%	16%	15%	19%	16.9%
Rental Car	1%	3%	2%	1.9%	20%	17%	19%	18.1%
HOV Modes	**38%**	**32%**	**33%**	**36.9%**	**29%**	**30%**	**27%**	**29.2%**
Unscheduled HOV	10%	9%	7%	8.1%	4%	5%	3%	3.7%
Scheduled HOV	11%	13%	12%	11.6%	10%	11%	6%	8.3%
Transit	14%	8%	11%	10.6%	12%	8%	9%	9.2%
Courtesy shuttle	2%	1%	3%	4.5%	3%	5%	5%	6.3%
Other	<1%	1%	1%	2.1%	<1%	1%	4%	1.7%

Source: Spring 1999, 2004, 2007, and 2010 Air Passenger Ground Access Surveys.

Air Passenger Ground Access Planning

Surface transportation modes have environmental impacts, and are considered a standard component of airport greenhouse gas (GHG) emissions inventories (see *Chapter 7, Air Quality/ Emissions Reduction*). Enhancing multimodal transportation options is one way an airport can reduce GHG emissions and improve its environmental footprint.

Potential emissions reductions are one reason why Massport is committed to a long-term goal to promote and support public and private HOV/shared-ride services aimed at serving air passengers, Airport users and employees. Other benefits include: (1) reducing congestion on the terminal roadways and curbside pick-up/drop-off areas, (2) alleviating limited parking facilities, and (3) customer service (providing a range of transportation options for different traveler markets).

Passenger HOV Mode Share Goal

Massport's ground access goal is to attain a 35.2 percent passenger HOV mode share when annual air passenger levels reach 37.5 million. The 35.2 percent HOV mode share figure was developed by a planning process involving Massport staff and was first presented in the Logan Growth and Impact Control (LOGIC) planning studies that were completed in the early 1990s.[14] In subsequent environmental documents, the 35.2 percent HOV mode share became a declared goal related to ground access to Logan Airport.[15]

Progress toward this goal is measured using the triennial air passenger ground-access survey. The latest survey, which was conducted in 2010, revealed an air passenger ground-access mode share of 30 percent for HOV/shared-ride modes, which is a share consistent with past surveys. (See detailed discussion in the previous section in this chapter.) This result demonstrates that Logan Airport has been able to maintain its HOV mode share in concert with improvements to roadway access to the Airport and despite increases in air passenger levels. Also, the result confirms Logan Airport's rank among the top U.S. airports with respect to HOV/shared-ride mode share.

It is useful to note that there is no standard aviation industry definition with respect to categorizing ground access modes as HOV versus SOV. While some modes (e.g., Logan Express and the Silver Line) clearly fall into the HOV mode category, the proper category for a limousine or taxi is less clear. For example, if Logan Airport ground access mode shares were recalculated using the same category definitions as are used by SFO, the Airport's HOV mode share would exceed 40 percent, ranking Logan Airport higher than SFO for HOV mode share.

Although generally useful, the calculation of overall HOV mode share is limited in that some modes can operate as both high occupancy and low occupancy vehicles. (Please refer to Table 5-11 below.) Many automobile modes carry multiple passengers; for example, as seen in Table 5-11, the 2010 survey results indicate an average occupancy of 2.3 air passengers per private vehicle used for airport ground access. Thus, if we were to view ground access share based on vehicle occupancy (and defining HOV as two or more air travelers) rather than type of vehicle category, the overall Logan Airport ground-access HOV share would rise to 71 percent and the SOV share would be 29 percent.

Table 5-11 Average Vehicle Occupancy by Ground Access Mode (2010, weekday)

Ground Access Mode	Average Vehicle Occupancy	% SOV	% HOV
Private Vehicle	2.3	31%	69%
Rental Vehicle	2.2	23%	77%
Taxicab	1.9	58%	42%
Van or Limousine by Reservation	2.9	40%	60%
Van or Limo Running on Fixed Schedule	4.4	24%	76%

Source: Massport calculations based on 2010 Logan Airport Air Passenger Ground-Access Survey

Another example of the shortcoming of calculating the ground-access goal in terms of mode only, without regard to occupancy, would be: two travel parties (i.e., passengers with different ground-access origins or different flight itineraries) sharing a taxi (effectively carpooling) to the Airport. This travel behavior, as

14 Logan Growth & Impact Control Study (LOGIC) Phase I Report (1990) and Logan Growth & Impact Control Study (LOGIC), Phase II Final Report (June 1993).

15 West Garage Final EIR (January 31, 1995) and 1994 & 1995 Annual Update of the Final Generic Environmental Impact Report (GEIR), vol. 1 (July 1996), which presents for the first time "Massport's Ground Access Management Plan" and states that its goals are "to achieve a 35 percent high-occupancy vehicle (HOV) mode share by air passengers…" [p. I-7-4]

currently measured, does not qualify as HOV and therefore does not contribute to achieving the mode share goal, because all travelers are still in an automobile, and not in a vehicle within the current definition of a HOV mode. As a result, even though sharing a taxi halved the number of vehicle trips that would otherwise have been required (i.e., one taxi ride was eliminated) and the number of pollutants emitted per passenger is halved, the trip by taxi would be counted in the automobile mode category. Simply using HOV mode share as a metric does not correlate to the number of vehicle trips generated or avoided by air passengers.

Massport is investigating alternative methods to describe the mode use and travel patterns of air passengers using Logan Airport in order to better reflect the vehicle occupancy and associated environmental outcomes.

Initiatives Underway

Massport promotes ridership on HOV/shared-ride modes and maintains efficient transportation access and parking options in and around Logan Airport to reduce the reliance on automobile modes as a means to achieving the HOV mode share goal. Measures implemented by Massport include a blend of strategies related to pricing (incentives and disincentives), service availability, service quality, marketing, and traveler information. Because of the diverse market segments of the air passenger traveler, not one single measure will accomplish the goal.

The March 2012 parking rate changes for Logan Airport commercial parking and Logan Express are a part of the recent package of initiatives to promote HOV/shared-ride ridership, as are the purchase of new low-floor, clean-fuel buses (which were placed into service in October 2012), the implementation of the unified shuttle bus system operation (fall of 2013), deployment of “next bus” arrival notification signs at the terminals and the MBTA Blue Line Airport Station (ongoing in 2012).

Beginning in the spring of 2012, Massport, in partnership with the MBTA and the Massachusetts Department of Transportation (MassDOT), introduced an intensive promotion of public transit to airport users. Marketing and promotion of public transit and Logan Express consisted of a multimedia campaign (including radio announcements, web advertising, banners, bus cards, bus wraps, etc.) and enhanced in-terminal signs, column wraps, and terminal floor decals, directed at arriving passengers.

These elements supported the introduction of a Silver Line pilot program on June 6, 2012, which permitted free boarding of the Silver Line buses at Logan Airport, in conjunction with added customer service staff during peak arrivals periods. This initial four-month pilot program was evaluated to assess the impacts on customer service, dwell times and curb operations, ridership changes and mode shifts, safety impacts, and fiscal impacts. The promising results of reduced dwell times and faster travel times through the terminal area led to the extension of the free-fare program through June 1, 2013.

Planning for Passenger Ground Access

Massport recognizes that a reduction in the use of passenger vehicles—principally taxis and private vehicles for curbside pick-up/drop-off—is necessary to ensure safe and uncongested operation of the terminal curbs and area roadways, while reducing the environmental impacts. To that end, Massport staff uses updated ground access data and the *2010 Logan Airport Air Passenger Ground Access Survey* to develop analytical tools than can inform ground access planning efforts.

For example, an analysis of passenger demographics and mode choice led to the creation of a parking pricing elasticity model. In essence, this analytical tool has demonstrated that on-Airport parking demand is strongly inelastic relative to pricing, and that the single strategy of adjusting parking rates will not dampen demand for on-Airport parking. The model also illustrates that reducing parking demand actually increases

curbside drop-off activity in higher proportions than increases in the use of any other modal alternative. Therefore, one conclusion from this analysis is that future ground-access initiatives should seek to primarily reduce demand for the use of curbside drop-off by private automobiles and taxis, in order to effectively reduce overall automobile mode share and make progress toward the HOV mode share goal.

The work to-date also produced an analysis of curbside and roadway level-of-service. This analysis has highlighted the need to address congestion at the Arrivals Level curbs of both Terminal B and Terminal C with both short-term measures and long-term initiatives. Massport is currently investigating some short-term measures expected to be placed in effect as early as the fall of 2013. This on-going work is providing the tools and establishing a framework to inform a broader, strategic, and long-range planning effort.

Employee Ground Access Planning

Airport employee transportation has different ground access considerations than passenger transportation. Airport employees often have non-traditional (and often unpredictable) working hours that are difficult to match to typical transit service hours. Due to the time-sensitive nature of airline operations, on-time reliability is important for employee transportation, as is flexibility during severe weather or other delays which may extend a typical employee workday or workshift.

Massport strives to reduce the number of Airport employees commuting by private automobile, to enhance commuter options, and to reduce traffic and parking demands at Logan Airport. To help accomplish these objectives Massport continues to:

- Provide off-Airport employee parking in Chelsea, which is served by frequent shuttle bus service to the terminals (Route 77).
- Run free employee shuttle buses between Airport Station and employment areas in the SWSA and the SCA locations (Routes 44, 66, and Logan Office Center).
- Operate early morning and late night Logan Express bus trips for commuters.
- Support the Logan Transportation Management Association (TMA).
- Support the Sunrise Shuttle for early morning bus service from East Boston.
- Create and maintain a comprehensive sidewalk/walkway system on Logan Airport to facilitate pedestrian access.
- Provide bicycle racks.[16]

16 Bicycle racks are provided at Terminal A, Terminal E, Logan Office Center, MBTA's Airport Station, Economy Parking Garage, Signature general aviation terminal, and the Green Bus Depot (Bus Maintenance Facility). Additional racks are planned in 2013 for the ConRAC facility.

Terminal A (left) and Terminal E (right) bike racks.
Source: Massport.

Logan Transportation Management Association (TMA)

Massport established the Logan TMA in 1997 with the following goals:

- Reduce Airport employee parking needs, traffic congestion, air pollution, and commuting costs by organizing/supporting alternatives to drive-alone commuting;
- Enhance public and private transportation services to Logan Airport through advocacy and support for expanded HOV/shared-ride services and discount fares for Airport employees;
- Provide a forum for Logan Airport tenants and employees to address common transportation concerns; and
- Work with government entities to create coordinated transportation management programs.

The Logan TMA advises Airport employers on transit benefits and provides information on available commuting transportation alternatives, ride-matching services, and reduced-rate HOV/transit fare options. Massport contributes $65,000 annually to the Logan TMA. The Logan TMA works with airlines, rental car companies, cargo transport companies, and other tenants at Logan Airport to encourage and offer commuting incentives to employees. Several companies offer a subsidy to employees using public transit or Logan Express to travel to work at the Airport. The TMA is open to all companies and their employees at Logan Airport. Therefore all employees are eligible to benefit from its services.

Benefits and services provided by the Logan TMA to Logan employees in 2011 included:

- East Boston early morning shuttle service (Sunrise Shuttle). (Further details are provided below.)
- Computerized ride-matching services for participating in carpools and vanpools.
- Advocacy for improved service and reduced fares for its members from Massport, the MBTA, or other providers of mass transit and other alternative forms of transportation.

Sunrise Shuttle

Originally launched in August 2007, this shuttle service provides low-cost transportation to Airport employees who live in nearby East Boston and Winthrop. A second shuttle route was added in October 2011 that serves East Boston's Orient Heights neighborhood and Winthrop. Both are partnerships between Massport and the Logan TMA to operate the Sunrise Shuttle; the second service was added with assistance from the Jobs Access and Reverse Commute (JARC) federal funding program.

The Sunrise Shuttle services operate outside of MBTA service hours between 3:00 AM and 6:00 AM, with shuttles every half-hour transporting employees to the Airport terminals. Ridership levels have steadily increased since the shuttle's launch. The two-route service has reached over 1,000 riders per month (up from 636 per month in 2010 on the single route).

Ground Access in 2030

The 2030 predictions for VMT and parking demand discussed below are based on forecast passenger activity levels in 2030 as detailed in *Chapter 2, Activity Levels.*

2030 VMT Analysis

The VMT analysis is based primarily on the predicted number of air passengers in 2030. In 2011, annual air passengers were 28.8 million; in 2030, air passengers are expected to reach 39.8 million. A VMT analysis was conducted for the year 2030 using the VISSIM model of Logan Airport. The number of air passengers and cargo operations for 2030 reflect an assumed average annual growth rate of approximately 1.7 percent or approximately 37.8 percent over 19 years. The annual growth rate in passengers and cargo operations was applied to the current gateway volumes with the mode shares remaining constant. Additionally, all remaining planned roadway improvements are assumed to be in place, including the completed ConRAC facility infrastructure, the surface to departure level ramp (an "official use only" recirculating roadway connecting from Harborside Drive directly to the departure level terminal road), and improvements to the Airport bus and shuttle system and routes. The 2030 VMT analysis also assumes that the bus/limousine pool has been moved to the SWSA.

Total VMT on the Airport roadway network is projected to increase by approximately 0.8 percent annually from 2011 through 2030. The increase in VMT is projected to grow at a rate lower than the growth in air passengers and cargo operations. This lower rate of VMT growth is due to the transition over to the new ConRAC facility scheduled to open in 2013 and the new surface to departure level ramp. One improvement associated with ConRAC is the relocation of a number of rental car providers and the taxi pool. These improvements help to either eliminate or shorten many existing trips. Table 5-12 summarizes the VMT results for 2030.

In 2030, annual air passengers are projected to increase to approximately 39,850,000. This represents an additional 11 million passengers (92 percent of whom are expected to use ground transportation at the Airport) that will have to be accommodated on the Airport roadway system and in its parking facilities.[17] In prior planning for the future development at Logan Airport as part of the Logan Modernization Program and subsequent planning efforts, facilities, roads and infrastructure were sized on a planning standard of 45 million annual air passengers. Thus, the Airport roadways were planned to accommodate currently anticipated increases in VMT and traffic volumes.

17 The remaining 8 percent are intra-terminal transfer passengers, therefore, they would not use the ground transportation network.

Table 5-12 Airport Air Passengers and Airport Study Area VMT for Airport-Related Traffic 2011 and 2030							
Analysis Year	Annual Air Passengers	Morning Peak Hour	Evening Peak Hour	High 8-Hour	Average Weekday	Average Weekday Percent Change	Annual Average Percent Change
2011	28.8 million	8,391	10,978	76,920	167,647	—	—
2030	39.8 million	10,099	14,273	90,843	195,762	16.8 %	0.8%

Source: VHB and Massport.

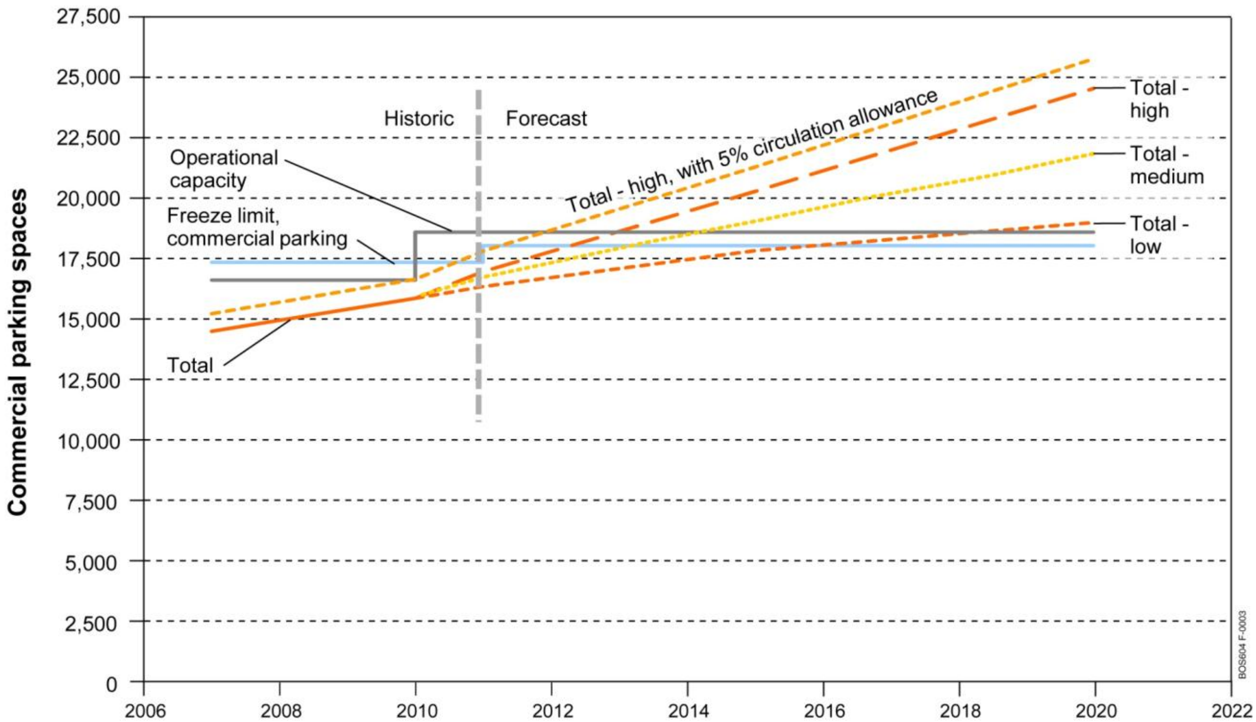
Future Parking Demand and Conditions Under Constrained Parking

According to research conducted for Massport, Logan Airport is already the only airport in the country where a traveler may not find a parking space of their choice on the Airport.[18] As described in the 2011 parking assessment summarized earlier in this chapter, on many weeks in 2011 and 2012, vehicles were periodically diverted from Central Parking to Economy Parking or Terminal E Lot 3. Early indications suggest that peak-day demand has not dampened since the March 2012 parking rate increases for on-Airport parking. However, parking demand may have decreased for non-peak days, such as Fridays and Saturdays.

With the Logan Airport Parking Freeze (and thus current capacity levels) remaining in place, demand will soon outpace supply on a regular basis. By 2014, if trends continue, parking demand will exceed available capacity on over half of the weeks of the year. With overflow conditions becoming such a regular occurrence, the ratio of growth in overall parking demand may begin to wane, but parking space utilization early in each week will remain at high levels. Under such conditions, travelers arriving at the Airport to park on Tuesdays and Wednesdays would find themselves unable to park their cars on Airport. The demand would simply exceed the available on-Airport spaces. Figure 5-13 illustrates the projected trend under three growth scenarios.

18 LeighFisher, August 2011.

Figure 5-13 Commercial Parking Forecast: "Design Day" Capacity Requirements



Source: LeighFisher, October 2011.

Although the uncertainty of on-Airport parking availability will lead some travelers to seek alternatives (modes, or perhaps airports), the share of HOV modes may not increase if the alternatives chosen are taxis and curbside drop-off by private vehicles. One model has indicated that this undesired behavior could occur: a predictive tool using elasticities between parking demand and pricing suggests that at higher parking rates three-quarters of those travelers who previously parked at the Airport for their flight would choose to be dropped-off at the curb (by taxi or private vehicle), and only a quarter of them would seek HOV/shared-ride modes.[19] Accordingly, private-vehicle travel and on-Airport VMT would increase under constrained parking supply or restrictive parking conditions.

Therefore, the challenge is how to influence a mode shift so that the passengers generating the excess parking demand are encouraged to use sustainable transportation modes (including public transit, high-occupancy vehicles (HOVs), and shared-ride services) rather than increase taxi and private vehicle drop-off and pick-up activity that would generate unacceptable levels of curbside congestion (and associated emissions). This is a key planning issue that Massport will address in future airport-wide planning efforts. Massport's longer-range ground access strategy will carefully consider both the parking constraint and new HOV initiatives.

19 LeighFisher parking demand modeling exercise, August 2011.

Historical Context and Trends

Historical trends are a useful way to assess how changes to the Logan Airport infrastructure affect ground transportation over time, however, they are based on projected future passenger levels and a status quo of all modes of access to the Airport. Therefore, 20-year projections of gateway volumes and VMT are not reliable enough to be used for transportation planning changes at this time.

A review of historical annual daily traffic volumes at the Airport gateways shows a moderate increase in traffic volume when compared to the projected increase in passengers. Since 1990, the number of annual air passengers has increased by about 20 percent, while gateway traffic has increased by 15 percent. By 2030, passenger levels are expected to increase by 45 percent, with a corresponding 29 percent increase in average daily traffic. This forecast assumes a constant mode share among the different modes providing ground transportation to/from the Airport. Table 5-13 summarizes historical and projected gateway Airport-related annual daily traffic.

Table 5-13 Gateway Airport-Related Annual Daily Traffic

Year	AADT	AWDT	AWEDT	Annual Air Passengers	Commercial Parking Spaces
1990	81,400	86,000	70,000	22,878,191	12,215
2000	95,058	101,446	78,358	27,412,926	14,090
2010	94,179	98,968	82,595	27,428,962	17,319
2030	**121,422**	**127,198**	**106,938**	**39,850,000**	

Source: Massport
Note: Parking spaces defined as commercial parking spaces allowed under the Logan Airport Parking Freeze.
AADT Annual average daily traffic.
AWDT Annual average weekday daily traffic.
AWEDT Annual average weekend daily traffic.

When comparing VMT, a 20 percent increase is projected in the 20-year period between 2010 and 2030 compared to the nearly 9 percent decrease realized over the past 10 years (even as annual air passenger levels in 2000 and 2010 were about the same). This VMT projection reflects air passenger level growth while minimizing increases in VMT due to improved terminal roadway connections and reduced on-Airport rental car company shuttle bus activity expected in the future. While the high 8-hour and average weekday VMT are higher in 2030, it is interesting to note that morning and evening peak hour VMT levels are approximately what they were historically in 2000 and 2001. This is attributed to the spreading of peak passenger arrival and departure at the Airport. Table 5-14 summarizes historical and project VMT for Airport-related traffic.

Table 5-14 Vehicle Miles Traveled (VMT) for Airport-Related Traffic

Analysis Year	Morning Peak Hour	Evening Peak Hour	High 8-Hour	Average Weekday
1990	5,700	7,700	50,100	104,500
2000	11,213	13,252	85,823	178,798
2010	8,451	10,887	78,185	162,885
2030	**10,099**	**14,273**	**90,843**	**195,762**

Source: Massport

Roadway Infrastructure: Changes since 1990

Significant changes have been made to the Airport's roadway infrastructure since 1990. In 1990, all Airport access was provided from Route 1A. A simple loop roadway provided terminal access along either side of East Boston Stadium. Terminals A and E were smaller, with large parking areas in front; and the Airport did not have separate arrival and departure levels. The Hilton Hotel was in a different location and the Hyatt Hotel and West Garage had not yet been constructed.

By 2000, major construction of the Logan Modernization project was underway and construction of the Central Artery/Tunnel project (CA/T) was mostly complete; both efforts were completed by mid-decade. The TWT, which had opened in 1995 only to authorized commercial vehicles, was now open for general traffic use on weekends, holidays, and off-peak times (as well as to certain authorized users at any time). In addition to providing a new way of accessing Route 1A, the TWT quickly became the primary gateway of access to the Airport. Furthermore, construction of the relocated Hilton Hotel, Hyatt Conference Center, and the West Garage was complete. Construction on the new MBTA Airport Station, Terminal E, and elevated walkways to Terminals B and C was underway. The current terminal roadway infrastructure was also mostly complete, although unopened to traffic. Plans to demolish Terminal A and connecting roadways were underway and set to begin reconstruction in the summer of 2002.

In 2010, the CA/T and Logan Modernization projects were complete. The infrastructure serving Airport access and supporting Airport operations is now immensely different from 1990, with the majority of the original loop roadway demolished. All Airport terminals now have separate arrival and departure levels and the more intricate, complex roadway system allows for better circulation between terminals and other Airport facilities, reducing VMT within the Airport limits. Moreover, consolidation of most surface Economy and overflow lots was completed in 2011, with the opening of the Economy Parking Garage.

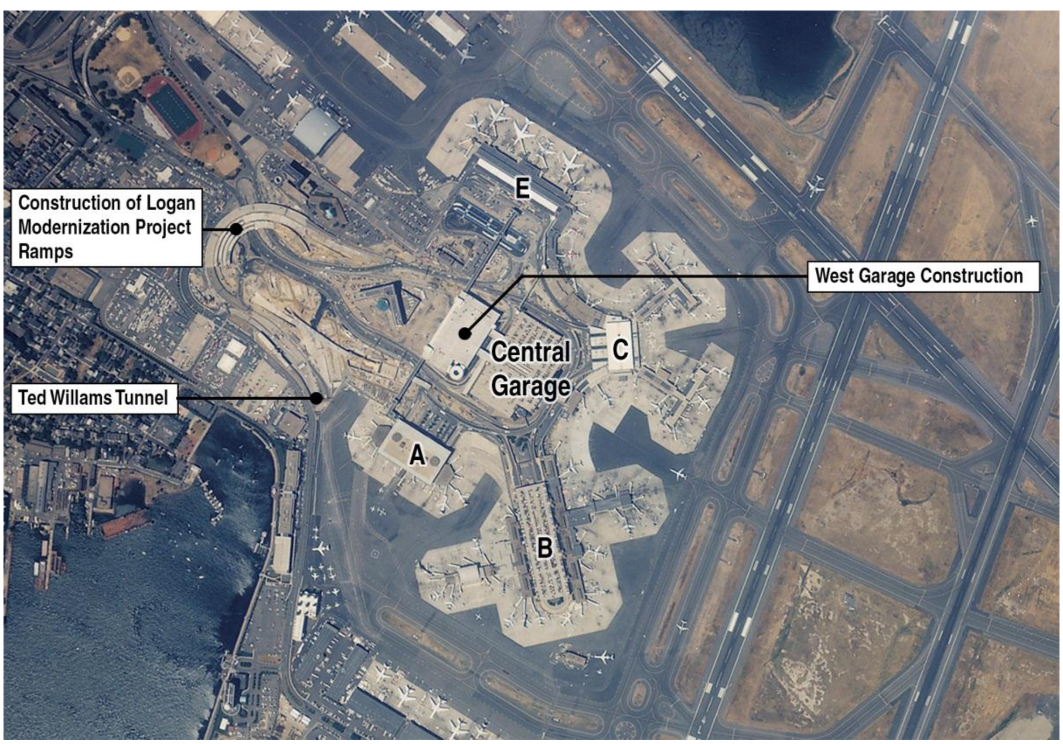
Figure 5-14 provides historic aerial references and key changes to the Logan Airport roadway network for the years described above.

Future Roadway and Infrastructure Projects

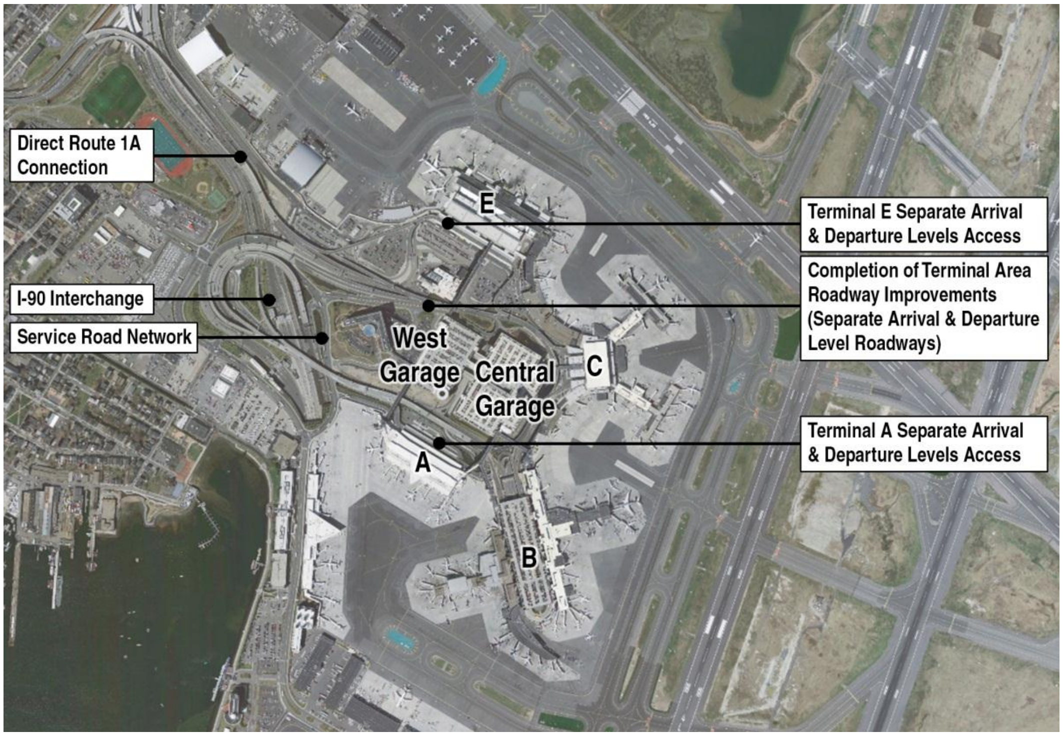
Although no major roadway changes are currently planned between now and 2030, Massport will be advancing a series of curb infrastructure improvements that will improve operations, HOV access, curb utilization, reduce curb dwell times, customer service, safety, and the environment beginning later in 2013. In addition, several additional projects that affect Airport traffic and circulation have recently been completed. Additional projects that are expected to be completed in the near future include: Terminal B improvements; improved connections between Terminals C and E; the SWSA Redevelopment; the relocation of the taxi and limousine pool; the East Boston- Chelsea Bypass Project; and the North Service Area Roadway Corridor project. The West Concourse at Terminal E is expected to be completed by 2030. Through these projects, Massport continues to improve efficiency on the Airport roadway system while minimizing Logan Airport's impacts off-Airport.

Figure 5-14 Logan Airport Roadway Network Changes, 1990-2010

1990



2000



2010 (Today)

Source: Massport

Ground Access Goals

Several elements of Massport's sustainability initiatives are reflected in the ground access planning activities, which are primarily aimed at reducing reliance on automobile modes by passengers, employees and other Airport users. These measures include:

- Provide, promote, and support HOV/shared-ride and non-motorized modes;
- Support and actively participate in the Logan TMA; and
- Improve terminal curbside access for HOV/shared-ride and non-motorized modes.

Table 5-15 lists each ground access goal and updates Massport's initiatives associated with each goal. Initiatives are planned, designed, implemented and continuously refined to account for the changing national, regional and local environments that affect Logan Airport and its users.

Table 5-15 Ground Access Planning Goals and Progress

Goal	2011 & 2012 Update
Increase air passenger ground access (high-occupancy vehicle) HOV mode share to 35.2 percent by the time Logan Airport accommodates 37.5 million annual air passengers	The *2010 Logan Airport Air Passenger Ground Access Survey* revealed that 30 percent of air passengers use HOV/shared-ride modes to access the Airport. Massport continues to provide and actively promote numerous HOV/shared-ride options to air passengers, including Logan Express bus service, the Silver Line, water shuttle service, and frequent, free shuttle bus service to and from the Massachusetts Bay Transportation Authority (MBTA) Blue Line rapid transit Airport Station. Massport is investigating ways to increase HOV mode share. In early 2012, Massport lowered its parking rates at the Logan Express sites in order to encourage use of the HOV/shared-ride service; early indications are showing increases in ridership. Also in early 2012, Massport increased its advertising and marketing of Logan Express and public transportation access to Logan Airport. This included radio ads, online banner ads, and ads in MBTA subway stations. In the summer of 2012, Massport partnered with the MBTA to offer free boardings of the Silver Line bus at the Airport; this pilot program will be evaluated to assess the effectiveness in increasing MBTA ridership, among other performance measures. Next-bus arrival digital dynamic signs have been added to the Terminal curb bus stops for the Silver Line, and are expected to later include Logan Express and other buses. Massport has taken a fresh look at wayfinding for ground transportation (with an emphasis on public transportation) within the terminals, resulting in enhanced directional signs in the terminals for arriving air passengers.
Reduce employee reliance on commuting alone by private automobile	Massport continues to fully support the Logan Transportation Management Association (TMA) with $65,000 annually (no dues are collected from Airport employers). Massport has also partnered with the Massachusetts Department of Transportation's (MassDOT) MassRIDES program, for further support of the Logan TMA coordinator. Massport uses funds from the Logan TMA to operate the early morning Sunrise Shuttle serving East Boston. In 2010, Massport and the Logan TMA successfully obtained Job Access and Reverse Commute (JARC) grant funding administered by the Federal Transit Administration to start a second Sunrise Shuttle route; this new service launched in the fall of 2011. For employees who reside in neighborhoods and communities closer to the Airport, bicycle parking options have increased with the installation of bicycle racks at Terminal E, the Economy Garage, and the Green Bus Depot in 2012. Additional racks are located at Terminal A, the Logan Office Center, and the Signature general aviation terminal. Racks are also planned for the new consolidated rental car facility (ConRAC) in 2013. Massport is also investigating ways to improve bicycle access to Logan Airport facilities, in addition to the infrastructure already planned/under-construction for the ConRAC.

Table 5-15 Ground Access Planning Goals and Progress (Continued)

Goal	2011 & 2012 Update
Increase the overall efficiency of the metropolitan transportation system through interagency coordination	Massport participates in the Metropolitan Planning Organization (MPO) to promote planning and funding of transportation system options that enhance access to the Airport. Massport and the MBTA have worked together on several initiatives including the renovated Blue Line Airport Station and the Silver Line service to Logan Airport. Following MassDOT's acquisition of a critical rail right-of-way, Massport constructed the East Boston-Chelsea bypass road (formally named Martin A. Coughlin Bypass Road), which adds an important roadway link to the Logan Airport ground access network. The road enhances both transit and commercial vehicle access to the Airport while reducing traffic and emissions in local East Boston neighborhoods. (The road opened to traffic in November of 2012.)
Improve management of on-Airport ground access and infrastructure through technology	Massport disseminates ground access and parking information through the Internet (www.massport.com), social media (Twitter and Facebook), a toll-free telephone number (1-800-23-LOGAN), Smartraveler, and in-Airport kiosks. Massport's redesigned website has an interactive tool that helps users access Logan Airport, while providing multimodal options.[20] Massport is designing a Ground Transportation Operations Center (GTOC) to be located in the new Consolidated Rental Car facility; this GTOC will incorporate state-of-the-practice intelligent transportation system (ITS) features for managing the unified shuttle bus system as well as other ground transport operations. In 2012, Massport began an evaluation of a Digital Passenger Information Program (DPIP). An objective of the program is to deploy digital signs to help customers with wayfinding in (and between) the terminals, including wayfinding to curbside transportation. The signs will provide flight information, ground transit/transportation information (including real-time bus arrivals for Logan Express and Silver Line buses), and assist with meeting some ADA goals of the Airport for visual paging. In 2012, Massport completed the development of its first mobile device-optimized website. The website, http://m.massport.com, offers Logan Airport-specific content reformatted for a small screen mobile device. Content includes information on flights, ground transportation, concessions, and parking. An improved mobile-optimized site is planned for release in 2013, which will include added features such as geo-aware wayfinding and improved ground transit functionality.
Provide adequate, long-term parking within the limits of the Logan Airport Parking Freeze	Massport consolidated several smaller overflow lots into a two-deck parking structure at the former Robie parcel. The Economy Parking Garage facility fully opened in March 2011. (The total number of parking spaces at the Airport remains within the Logan Airport Parking Freeze. Refer to the comprehensive discussion of parking allocations in this chapter and shown in Table 5-4.)

Source: Massport

20 Massport, GetUthereApp, www.massport.com/massport/gtu/Pages/default.aspx.

6

Noise Abatement

Introduction

The Massachusetts Port Authority (Massport) strives to minimize the noise effects of Logan Airport operations on its neighbors through the use of a variety of noise abatement programs, procedures, and other tools. Logan Airport has one of the most extensive noise abatement programs of any airport in the nation. Massport's comprehensive noise abatement program includes residential and school sound insulation programs; flight tracks designed to optimize over-water operations (especially during nighttime hours); and preferential runway use goals. The foundation of Massport's program is the *Logan Airport Noise Abatement Rules and Regulations*[1] (the Noise Rules), which have been in effect since 1986. Massport's Noise Abatement Office is responsible for implementing noise abatement measures and generally monitoring community complaints and other aspects of the noise effects from Logan Airport operations.

This chapter describes predicted noise conditions at Logan Airport related to operations during 2011 and compares the findings to those for 2010 and anticipated future conditions in 2030. This *2011 Environmental Status and Planning Report (ESPR)* provides an opportunity to revisit previous forecasts completed in 2004 and update them based on current and predicted conditions. Massport's updated forecast is for the long-range planning horizon, 2030. As such, the 2030 noise analyses are based on the likely aircraft operations and fleet mix in 2030. ESPRs, which provide a comprehensive, cumulative analysis of noise conditions at Logan Airport, are completed roughly every five years and Environmental Data Reports (EDRs) are completed annually. There will be opportunities to revisit the 2030 forecast based on the most current data available at the next ESPR cycle if necessary. For further information on the development of the 2030 long-range forecast, refer to *Chapter 2, Activity Levels.*

Noise conditions for 2011 were assessed primarily through computer modeling, supplemented by the analysis of measured noise levels from Logan Airport's noise monitoring system. The chapter presents summaries of the operational data used in the noise modeling, as well as the resultant average annual Day-Night Sound Level (DNL) noise contours, a comparison of the modeled results with measured levels from the noise monitoring system, and estimates of the population residing within various increments of noise exposure. Analyses also include a number of supplemental noise metrics including Logan Airport's Cumulative Noise Index (CNI) and reporting on the time above (TA) various threshold sound levels and periods of dwell and persistence of noise levels. Massport's progress on implementing noise abatement measures also is presented.

1 *Logan Airport Noise Abatement Rules and Regulations* are codified at 740 CMR 24.01 et seq.

This chapter also reports on noise conditions developed for the most recent long-range forecast (2030) developed for Logan Airport. Levels of operations from the forecast and future runway use developed from Federal Aviation Administration (FAA) long term simulation modeling are reported. Computer modeling was used to develop a set of DNL noise contours for 2030. This long term forecast and modeling provides a good outlook of the future noise environment. The 2030 noise results are compared to 2011 and 2000, which is the last year Logan Airport had operational levels above 1,300 operations per day. This DNL contour is also presented with DNL contours from each decade since 1980 to show a historical context.

Appendix H, Noise Abatement provides historical details of operations, runway use, the sound insulation program and noise exposed population back to 1990. The appendix also contains the Flight Track Monitoring Report for 2011 and a Fundamentals of Acoustics and Environmental Noise section, which gives an introduction to key noise issues and terminology for the general reader.

Key Findings

In 2011, the following changes occurred in the airport and noise environment:

- Annual aircraft operations increased from 352,643 in 2010 to 368,987 in 2011 (4.6 percent increase) with commercial operations increasing by only 0.8 percent and an increase in general aviation (GA) operations responsible for the remaining increase. GA operations almost doubled from 2010 from 14,682 operations in 2010 to 28,230 operations in 2011. GA operations are recovering from the large declines experienced over the past two years and are returning to average levels at the Airport. GA operations still represent only a small percentage (7.7 percent) of total operations at Logan Airport.
- The number of aircraft operations in 2011 remained well below historic peak levels (1,396 operations per day in 1998). Since 2000, the number of aircraft operations has declined 25.4 percent (from 1,355 operations per day in 2000 to 1,011 operations per day in 2011) while passenger levels have reached a new peak. Daily operations in 2011 averaged approximately 1,011 operations per day compared to approximately 966 operations per day in 2010.
- Compared to 2010, the 2011 DNL decibel (dB) contours were smaller in East Boston and over Boston Harbor toward Hull. The DNL 65 dB contour was slightly larger in Revere, South Boston, and in most of Winthrop for 2011. There are several factors that influenced the contour changes, including:
  - Runway 15R-33L, which is the nighttime noise abatement runway, was temporarily closed from July through September and during the daytime in June, October and November of 2011 to allow for construction of the enhanced Runway 33L Runway Safety Area (RSA). Typically, this runway is used during these periods for head to head operations (arrivals to Runway 33L and departures from Runway 15R) at night, which keeps air traffic over Boston Harbor.
  - During the Runway 15R-33L closure period, night operations primarily used Runway 22R and Runway 9 for departures and Runway 4R and 22L for arrivals.
  - The Runway 15-33L closure resulted in the reduction in noise levels in East Boston and the slight increase in noise levels in Revere and Winthrop.

- The overall number of people exposed to DNL values greater than 65 dB increased to 3,947 people in 2011 from 3,830 people in 2010 (an increase of 117 people).[2] The number of people residing within the DNL 70 dB contour remained at 130 people. These levels are well below the numbers of people exposed in the year 2000 when 17,745 people were exposed to DNL noise levels greater than 65 dB and 1,551 people were exposed to DNL levels greater than 70 dB.
- The 2011 CNI of 152.1 Effective Perceived Noise Decibels (EPNdB) remained well below the cap of 156.5 EPNdB established under Massport's noise regulations. This small increase from the 2010 level is due to a small increase in overall operations and a small increase in nighttime operations.
- In 2011, Massport provided sound insulation to 114 homes, 84 percent of which were in Chelsea. The focus of the program in Chelsea was to fulfill federal and state mitigation commitments related to the opening of Runway 14-32. Since the inception of Massport's residential sound insulation program (RSIP), 11,333 homes have received sound insulation treatment in East Boston, South Boston, Winthrop, Revere, and Chelsea.
- Massport has an extensive sound insulation program in the areas surrounding Logan Airport. All of the residences exposed to levels greater than DNL 65 dB in 2011 have been eligible to participate in Massport's RSIP. Participation in the program is voluntary and all of the homeowners who have chosen to participate in the Massport's RSIP, have been sound insulated by Massport.

Airspace and Airfield Changes:

- The aRea NAVigation (RNAV) departure portions of Phase 1 of the Boston Logan Airport Noise Study (BLANS), first implemented in 2010, were fully in use in 2011. The primary focus of the BLANS is to determine viable ways to reduce noise from aircraft operations to and from Logan Airport without diminishing airport safety and efficiency.[3] The Runway 33L departure is the last RNAV procedure to be implemented. FAA completed an Environmental Assessment (EA) in January 2013, and the comment period for the EA was extended to March 15, 2013 (from February 15, 2013), with a 6-month reevaluation of the RNAV. All other major Logan Airport runways that are capable of accommodating RNAVs have been implemented by the FAA and are in operation today.
- The 2011 Flight Track Monitoring report in *Appendix H, Noise Abatement* shows that over 98 percent of shoreline crossings are by aircraft above 6,000 feet, reflecting a slight increase from 2010. The average altitude from 2010 to 2011 increased 790 feet to 11,508 feet above mean sea level (MSL).
- The recent changes to the Runway 27 departure procedure and aircraft technology improvements have improved the compliance with the Runway 27 Record of Decision (ROD). The FAA has determined that no further evaluation is needed.[4] Massport will continue to monitor and publish compliance with the procedure in the annual Flight Track Monitoring Report in the EDRs and ESPRs. The visual approach procedure (Light Visual Approach) to Runway 33L which began during the summer of 2009, continued in 2011. The procedure, also an outcome of Phase 1 of BLANS, keeps aircraft offshore avoiding areas of Cohasset and Hull at night in good weather when visual flight rules are in use.

2 Population data was derived from the most recent 2010 United States (U.S.) Census.
3 For more information, visit the Boston Logan Airport Noise Study (BLANS) Website at www.bostonoverflightnoisestudy.com/index.aspx.
4 FAA Rwy 27 Advisory Committee Meeting Notes 01/23/12; published March 5, 2012.

Based on the 2030 forecast of aircraft operations and expected aircraft fleet mix, the following conditions are expected in 2030:

- There is forecast to be a larger number of operations and a higher percent jet fleet than in 2011. The higher level of operations is not a capacity challenge as the Airport has operated in the past with over 1,300 operations per day. For example, there were 1,355 operations per day in 2000 when there were only five runways instead of the current six.
- The 2030 fleet mix consists of 81 percent commercial jets whereas the 2011 fleet mix consists of 78 percent commercial jets. The 2000 fleet mix had a lower proportion of commercial jets at 62 percent of the fleet.
- Total operations are expected to increase by 29 percent or 290 operations per day from 2011 to 2030, from 1,011 operations per day in 2011 to 1,301 operations per day in 2030. Compared to 2000, which is the last year that Logan Airport had over 1,300 daily operations, 2030 is forecasted to have 54 fewer daily operations (1,355 in 2000 and 1,301 in 2030). Daytime commercial operations are projected to increase by 254 operations per day from 819 in 2011 to 1,073 in 2030, however this is still fewer than the 1,142 daytime operations in 2000. Nighttime commercial operations are projected to increase from 114 in 2011 to 154 in 2030. This is an increase compared to 2000 when 126 daily operations occurred at night.
- Daytime GA operations are projected to decrease slightly from 71 per day in 2011 to 67 per day in 2030 (a decrease of 6 percent) and nighttime GA operations are projected to also decrease slightly from 6.7 in 2011 to 6.5 in 2030 (a decrease of 3 percent). In 2000, daytime GA operations were significantly higher at 82 daily operations with nighttime GA daily operations slightly lower at 5.7 operations.
- The 2030 forecast assumes the continued use of the highest capacity runway configurations (Runway 4L and 4R for arrivals and Runway 9 for departures and Runway 27 for arrivals and Runway 22L and 22R for departures) consistent with today's runway use. The same higher capacity runway combinations were used in 2000 (78 percent of the arrivals used Runways 4L, 4R, 22L and 27 with 68 percent of the departures on Runways 9, 22L and 22R).
- The 2030 operations forecast produced a larger set of DNL noise contours with the number of people exposed to noise levels greater than DNL 65 dB increasing from 3,947 in 2011 to 12,211 people in 2030. This is still significantly fewer than the number of people exposed in 2000 (17,745 people). The number of people within the DNL 70 dB is also projected to increase from 130 in 2011 to 352 people in 2030 but still remaining well below the 1,551 people within the DNL 70 dB in 2000. All of the residences within the forecasted 2030 DNL 65 dB contour are in areas where Massport has implemented its sound insulation program.

Noise Metrics

The common metrics used to describe and evaluate aircraft noise in this chapter are:

- The Decibel (dB) – The standard unit of measure for sound. It is a logarithmic quantity reflecting the ratio of the pressure of the sound source of interest and a reference pressure. This logarithmic conversion of sound pressure to sound pressure level results in a sound pressure level of about zero dB for the quietest sounds that one can detect and sound pressure levels of about 120 dB for the loudest sounds we can hear without pain. Many sounds in our daily environment have sound pressure levels on the order of 30 to 100 dB.
- The Day-Night Average Sound Level (DNL) – A measure of the cumulative noise exposure over a 24-hour day. It is the 24-hour, logarithmic (or energy) average, A-weighted sound pressure level with a 10 dB penalty applied to the nighttime event levels that occur between 10:00 PM and 7:00 AM. The DNL is the FAA-defined metric for evaluating noise and land use compatibility.

- Time-Above a Specified Level (TA) – The TA metric describes the total number of minutes that instantaneous sound levels (usually from aircraft) are above a given threshold. For example, if 65 dB is the specified threshold, the metric would be referred to as "TA65." The TA metric is typically associated with a 24-hour annual average day but can be used to represent any time period. Any threshold may be chosen for the TA calculation. For this study, TA65, TA75, and TA85 were computed at each of the monitoring sites.
- Effective Perceived Noise Level (EPNL) – A time series of "tone corrected" perceived noise levels are used to compute EPNL which is expressed in units of EPNdB. The tone corrected perceived noise level is determined by measuring the perceived noise level and adding to that value a "pure-tone" correction of up 6 dB. The EPNL is an international standard for the noise certification of aircraft and is used in this report in the calculation of the CNI.

Regulatory Framework

FAR Part 36

Logan Airport operates within a framework of federal aviation regulations that limits an airport operator's ability to control noise. For example, the FAA's Federal Aviation Regulation (FAR) Part 36[5] sets noise limits for aircraft certification and the procedures by which aircraft noise emission levels must be measured to determine compliance. The regulation defines noise emission limits for turbojets, turboprops, and helicopters, classifying turbojets into categories referred to as stages based on noise levels at each of three locations: takeoff, landing, and to the side of the runway during takeoff (sideline). The stages are:

- Stage 1 aircraft are the oldest and usually have the loudest operations, having preceded the existence of any noise emission regulation. Rare examples include old, restored civil or military aircraft. There are no Stage 1 aircraft operating at Logan Airport.
- Stage 2 aircraft are less old and less noisy than Stage 1; they were the first aircraft types required to meet a noise limit. A subsequent regulation, FAR Part 91 (described in the next section), prohibits the operation of a Stage 2 aircraft in the continental U.S. unless its takeoff weight is 75,000 pounds or less. The FAA Reauthorization bill of 2012 also mandates the phase out of Stage 2 aircraft with a takeoff weight less than 75,000 pounds by 2015. Less than 0.1 operations per day (approximately 33 operations) occurred at Logan Airport in 2011.
- Stage 3 aircraft were certified for service before 2006 and have relatively quiet jets, although some are Stage 2 aircraft that have been re-engined or have been fitted with hushkits which enable them to meet Stage 3 noise limits.
- Stage 4 aircraft are the newest and quietest of the jets. These aircraft will be required to operate with noise levels at least 10 dB quieter than Stage 3 aircraft at three prescribed measurement points. Jet aircraft certificated after January 1, 2006 must meet the Stage 4 limits. Although not required, the majority of aircraft in the 2011 Logan Airport fleet would also meet the new Stage 4 noise limits if they were recertificated.

5 14 CFR Part 36, "Noise Standards: Aircraft Type and Air Worthiness Certification."

FAR Part 150

First implemented in February 1981, FAR Part 150[6] defines procedures that an airport operator must follow if it chooses to conduct and implement an airport noise and land use compatibility plan. Part 150 Noise Compatibility studies require the use of DNL to evaluate the airport noise environment. FAR Part 150 identifies noise compatibility guidelines for different land uses depending on their sensitivity. Key values include a DNL of 75 dB, above which no residences, schools, hospitals, or churches are considered compatible, and a DNL of 65 dB, above which those land uses are considered compatible only if they are sound insulated.

Noise abatement or mitigation measures that an airport operator must consider in a Part 150 study include acquisition of incompatible land, construction of noise barriers, sound insulation of buildings, implementation of a preferential runway program, use of noise abatement flight tracks, implementation of airport use restrictions, and any other actions that would have a beneficial effect on the public.

While Massport has implemented variations of all of these and additional measures at Logan Airport, Massport has not filed an official Part 150 noise compatibility study with the FAA because all of Logan Airport's program elements, while regularly reviewed and updated, preceded the promulgation of Part 150 and are effectively grandfathered under the regulation.

FAR Parts 91 and 161

The Airport Noise and Capacity Act of 1990 (ANCA)[7] directed the U.S. Secretary of Transportation to undertake three key noise-related actions:

- Establish a schedule for a phase out of Part 36 Stage 2 aircraft by the year 2000;
- Establish a program for FAA review of all new airport noise and access restrictions limiting operations of Stage 2 aircraft; and
- Establish a program for FAA review and approval of any restriction that limits operations of Stage 3 aircraft, including public notice requirements.

The FAA addressed these requirements through amendment of an existing federal regulation, "Part 91,"[8] and establishment of a new regulation, "Part 161."[9] ANCA effectively ended Massport's pursuit of any additional operational restrictions outside of this program.

Amendment to Part 91

The FAA establishes and regulates operating noise limits for civil aircraft operation in Subpart I, "Operating Noise Limits," of 14 CFR Part 91, "General Operating and Flight Rules." The noise limits are based on aircraft noise certification criteria set forth in 14 CFR Part 36, "Noise Standards: Aircraft Type and Airworthiness Certification." For transport category "large" aircraft (with maximum takeoff weights of 12,500 pounds or more) and for all turbojet-powered aircraft, Part 36 identifies four "stages" of aircraft with respect to their relative noisiness:

- Stage 1 aircraft, which have never been shown to meet any noise standards, because they have never been tested, or because they have been tested and failed to meet any established standards;
- Stage 2 aircraft, which meet original noise limits, set in 1969;
- Stage 3 aircraft, which meet more stringent limits, established in 1977; and

6 14 CFR Part 150, "Airport Noise Compatibility Planning."
7 Pub. L. No. 101-508, 104 Stat. 1388, as recodified at 49 United States Code (U.S.C.) 47521- 47533
8 14 CFR Part 91, "General Operating and Flight Rules".
9 14 CFR Part 161, "Notice and Approval of Airport Noise and Access Restrictions".

- Stage 4 aircraft, which meet the most stringent limits, established in 2005.

In 1976, the FAA ordered a phase out of all Stage 1 aircraft with a maximum gross takeoff weight (MGTOW) over 75,000 pounds, to be completed on January 1, 1985. After that date, Stage 1 civil aircraft over 75,000 pounds MGTOW were banned from operating in the U.S. (with limited exemptions related to commercial service at "small communities," which has since expired in 1988). ANCA required a similar phase out of Stage 2 aircraft over 75,000 pounds by December 31, 1999. The 75,000 pound weight limit exempts most "business" (or "corporate") jets and a very small number of the very smallest "air carrier" type jets until December 31, 2015 when a full ban will take effect.[10] Aircraft operators responded to the Stage 1 and 2 phase outs by retiring their non-compliant aircraft or modifying some of their aircraft to meet the more stringent standards. The modifications undertaken include installation of quieter engines, noise-reducing physical modifications to the airframe and/or existing engines, and limitation of operating weights and procedures so as to meet the applicable Part 36 limits. Some former Stage 2 airline aircraft that were "recertificated" as Stage 3 with these modifications still operate at Logan Airport, but are generally declining due to the aircrafts' age and high operating costs (in particular due to the generally low fuel efficiency of these older aircraft).

Part 161

FAA implemented the ANCA requirements related to notice, analysis, and approval of use restrictions affecting Stage 2 and 3 aircraft through the establishment of a new regulation, 14 CFR Part 161, "Notice and Approval of Airport Noise and Access Restrictions." In simple terms, Part 161 requires an airport operator that proposes to implement a restriction on Stage 2 or 3 aircraft operations to undertake, document, and publicize certain benefit-cost analyses, comparing the noise benefits of the restriction to its economic costs. Operators must obtain specific FAA approvals of the analysis, documentation, and notice processes, and – for Stage 3 restrictions – approval of the restriction itself.

Part 161 and ANCA define more demanding requirements and explicit guidance for Stage 3 restrictions. To implement a Stage 3 restriction, formal FAA approval is required. The FAA's role for Stage 2 restrictions is limited to commenting on compliance with Part 161 notice and analysis procedural requirements. Part 161 provides guidance regarding appropriate information to provide in support of these findings. While Part 161 does not require this information for a Stage 2 restriction, Part 161 states that it would be "useful." Moreover, the FAA has required airports to provide this same information for Stage 2 restrictions (and even for Stage 1 restrictions pursued under FAR Part 150), on the grounds that they are required for airports to comply with grant assurance 22(a), "Economic Nondiscrimination," which states that an airport operator "will make its airport available as an airport for public use on fair and reasonable terms and without unjust discrimination to all types, kinds, and classes of aeronautical use."[11]

Although several (on the order of a dozen) airports have embarked on efforts to adopt both Stage 2 and 3 restrictions in the past two decades, the FAA has found that only one, Naples Municipal Airport, a GA airport in Naples, Florida, has fully complied with Part 161 analysis, notice, and documentation requirements for a ban on Stage 2 jet operations. FAA found the airport was in violation of prior FAA grant assurances. The airport operator successfully sued the FAA to overturn that ruling and has implemented the restriction.

ANCA and Part 161 specifically exempt Stage 3 use restrictions that were effective on or before October 1, 1990 and Stage 2 restrictions that were proposed before that date. The Logan Airport Noise Rules were

10 The FAA Modernization and Reform Act of 2012 sets a January 1, 2016 ban of Stage 2 aircraft less than 75,000 lbs.

11 FAA Order 5196, "Airport Compliance Requirements," Chapter 4, Section 2, paragraph 4-8f states that to satisfy this grant assurance requirement: Airport use restrictions: (1) must be reasonably consistent with reducing noncompatibility of land uses around the airport; (2) must not create an undue burden on interstate or foreign commerce; (3) must not be unjustly discriminatory; (4) must not derogate safety or adversely affect the safe and efficient use of airspace; (5) meet both local needs and the needs of the national air transportation system to the extent practicable; and (6) must not adversely affect any other powers or responsibilities of the FAA Administrator prescribed by the law or any other program established in accordance with the law.

promulgated in 1986; therefore, ANCA and Part 161 have no bearing on their continued implementation in their current form. Any future proposals to make the rules more stringent with regard to Stage 2 operations or to restrict Stage 3 operations in any way would almost certainly trigger Part 161 notice, analysis, and approval processes for Stage 3 restrictions. In 2006, Massport requested an opinion from the FAA regarding the pursuit of a Part 161 waiver or exemption to allow Massport to implement a curfew of nighttime operations of hush-kitted Stage 3 aircraft. FAA informed Massport that a waiver or exemption from the requirements of Part 161 is not authorized under, or consistent with, federal statutory and regulatory requirements. A copy of FAA's letter to Massport was provided in *Appendix H, Noise Abatement* of the *2005 EDR.*

Logan Airport Noise Abatement Rules and Regulations

Massport's primary mechanism for reducing noise impacts from Logan Airport's operations is the Noise Rules. The Noise Rules were designed to reduce noise impacts by encouraging use of quieter aircraft by requiring decreased use of noisier aircraft and by limiting nighttime activity by louder Stage 2 types. Many secondary goals aimed at limiting noise in specific areas also were stated.

Specific provisions of the Noise Rules, which continue to serve these goals, include:

- Limiting cumulative noise exposure at Logan Airport (as measured by Massport's CNI) to a maximum of 156.5 EPNdB;
- Maximizing use of Stage 3 aircraft;
- Restricting nighttime operations by Stage 2 aircraft;
- Placing limitations on times and locations of engine run-ups and use of auxiliary power units (APU); and
- Restricting use of certain runways by noisier aircraft and time of day.

Noise Modeling Process

The DNL, CNI, and TA noise metrics reported annually by Massport provide various means of interpreting and comparing Logan Airport's complex noise environment from one year to the next. The noise context is influenced by numbers of operations, types of aircraft operating during the day and at night, use of various runway configurations, and the location and frequency of use of flight paths to and from the runways. Changes in any one of these operational parameters from one year to the next can cause changes in the values of the noise metrics and alter the shapes of the noise exposure contours that represent the accumulation of noise events during an average day.

Massport continues to make use of state-of-the-art improvements in the noise modeling process, which has been updated each year. These developments in noise modeling technologies and techniques, which were first employed in the preparation of the *2005 EDR*, and have continued through this *2011 ESPR,* include:

- Continued use of the latest version update to the FAA's Integrated Noise Model (INM), while retaining the unique capability to account for over-water sound propagation and hill effects at Logan Airport. Massport's use of the latest FAA-approved version of the INM (INMv7.0c)[12] to model the 2011 noise conditions, along with additional provisions approved by FAA to accommodate the Airport's unique water and terrain characteristics that have been shown through earlier technical studies to affect sound

12 INM Version 7.0c was released in January 2011.

propagation into surrounding neighborhoods, has improved the modeling results. Logan Airport is the only airport in the world that incorporates these features into its approved modeling process.

- This *2011 ESPR* is the third year the AirScene.com data has been used for all aspects of the modeling process. The measured noise and the flight track data all come from the Massport (Noise and Operations Management System) NOMS.
- The flight operations data from the NOMS system includes more information with each flight record, such as aircraft registration numbers, wherever possible providing better INM aircraft type selection. This allows for the assignment of the modeled INM aircraft type based on the specific aircraft and engine combination used on each flight at Logan Airport during 2011.
- The modeling process includes continued use of U.S. Geological Survey (USGS) digital terrain data. INMv7.0c uses the detailed terrain data to evaluate each receptor location at its proper elevation, which enhances the accuracy of the results.
- Inputs to the modeling process include use of automated altitude profile and noise contour generation software. Massport purchased licenses to run two additional software packages, RealProfiles™ and RealContours™.[13] The *2004 ESPR* included a comparative analysis of the results of the standard INM modeling approach with RealProfiles™ and RealContours™.
  - RealContours™ automates the production of noise contours directly from every individual radar trace. Approximately 371,162 traces were collected from the system and 350,343 traces retained enough information to be modeled in the RealContours™ system. Each radar trace was converted to an INM model track, ensuring that the lateral dispersion of radar tracks was retained in the modeling. The operations on these radar traces were then scaled to account for all of the 368,987operations in 2011. This method also helps to develop more accurate noise contours by retaining the actual runway used and time of each operation.
  - RealProfiles™ analyzes each radar trace and automatically produces custom aircraft performance profiles using the INM aircraft database. The INM typically uses pre-defined profiles to "fly" each aircraft along the ground track. The custom profiles are designed to follow the actual flight of each aircraft allowing the INM to model each flight at its actual location on the ground and in the sky. Due to changes in the INM model (Airbus aircraft now have new arrival data to support RealProfiles™), many more arrival profiles are available for use with RealProfiles™. A total of 335,950 flight tracks (95.7 percent) used these specially designed profiles of which 174,700 (99.7 percent) of the available departure profiles and 161,250 (91.4 percent) of the available arrival profiles are profiles developed from the actual radar data.
- Accurate altitude modeling by using the aircraft performance profiles developed by RealProfiles™ from the radar data enhances the modeled noise results at each of the monitoring sites. This software incorporates the FAA-approved INMv7.0c as the computational engine for calculating noise, but provides greater detail through the uses of individual flight tracks taken directly from radar systems rather than relying on consolidated, representative flight tracks data.

RealContours™ improves the precision of modeling by:

- Directly converting the radar flight track for every identified aircraft operation to an INM track, rather than assigning all operations to a limited number of prototypical or representative tracks;

13 RealProfilesTM and RealContoursTM are methods to provide more accurate inputs to the INM but do not change or modify the algorithms of the FAA-required INM.

- Modeling each operation on the specific runway that it actually used, rather than applying a generalized distribution to broad ranges of aircraft types;
- Selecting the specific airframe and engine combination to model, on an operation-by-operation basis, based on the published composition of the fleets of the specific airlines operating at Logan Airport; and
- Using each aircraft's actual performance and altitude profile to develop inputs to the model which define the actual arrival or departure profile.

RealContours™ uses INMv7.0c to produce computations for each day of radar data and then compiles annual average noise exposure contours and supplemental metrics from each of the 365 days of computations. All of these enhancements are examples of Massport's continued commitment to improving the monitoring, reporting, and understanding the noise environment at Logan Airport. The following section of this chapter summarizes the basic operational data used to compute the DNL, CNI, and TA noise metrics reported for 2011.

Noise Model Inputs

The FAA's INMv7.0c was released for general use on January 3, 2011, and has been used for the *2010 EDR* and the *2011 ESPR* as the primary analytical tool to assess the noise environment at Logan Airport. A comparison of the enhancements between INMv7.0c, and the prior version of INM, INMv7.0b was included in the *2010 EDR*.

The INM requires detailed operational data as inputs for its noise calculations, including numbers of operations per day by aircraft type and by time of day, which runway for each arrival and for each departure, and flight track geometry for each track. These data are summarized in tables that follow or are included in *Appendix H, Noise Abatement.* The following section summarizes the average-day operations for 2011 used in the noise modeling and compares them to 2010 data. Operations and fleet mix assumptions for 2030 are described later in this chapter.

Fleet Mix

Since 2004, Massport has relied primarily on radar data as the main source of input for noise calculations, since radar data typically are more accurate than the information reported by air carriers. The radar data result in a list of approximately 500 different aircraft types that use Logan Airport during a year, including the wide variety of small corporate jets and propeller aircraft flown by GA users, as well as the large passenger and cargo jets operated by air carriers. For 2011, the aircraft types identified by the radar data were matched to the INMv7.0c database, which contains individual noise and performance profiles for 265 different fixed-wing aircraft types, 150 of which represent civilian aircraft, the balance being military aircraft.[14] For those aircraft recorded in radar data that are not in the INM's database, the radar type is paired with the best available alternative using a standard FAA-approved substitution list. The final list of modeled aircraft, used as an input to the INM, is presented in detail in *Appendix H, Noise Abatement*.

As in previous ESPRs and EDRs, operations by aircraft types have been summarized into several key categories: commercial (passenger and cargo) operations, Stage 2 or Stage 3 jet aircraft, and turboprop and propeller (non-jet) aircraft. Aircraft that meet Stage 4 jet requirements are also broken out from the Stage 3 jet aircraft data for 2010 and 2011. These Stage 4 aircraft are defined as aircraft certified as Stage 4 and all Stage 3 aircraft which, if recertified, would qualify as Stage 4 aircraft. FAA does not require aircraft to be recertified and there are no plans at this time to restrict Stage 3 operations. In addition, the operations are split into daytime and nighttime periods, where nighttime hours are defined as 10:00 PM to 7:00 AM, consistent with the definition of DNL. Table 6-1 summarizes the numbers

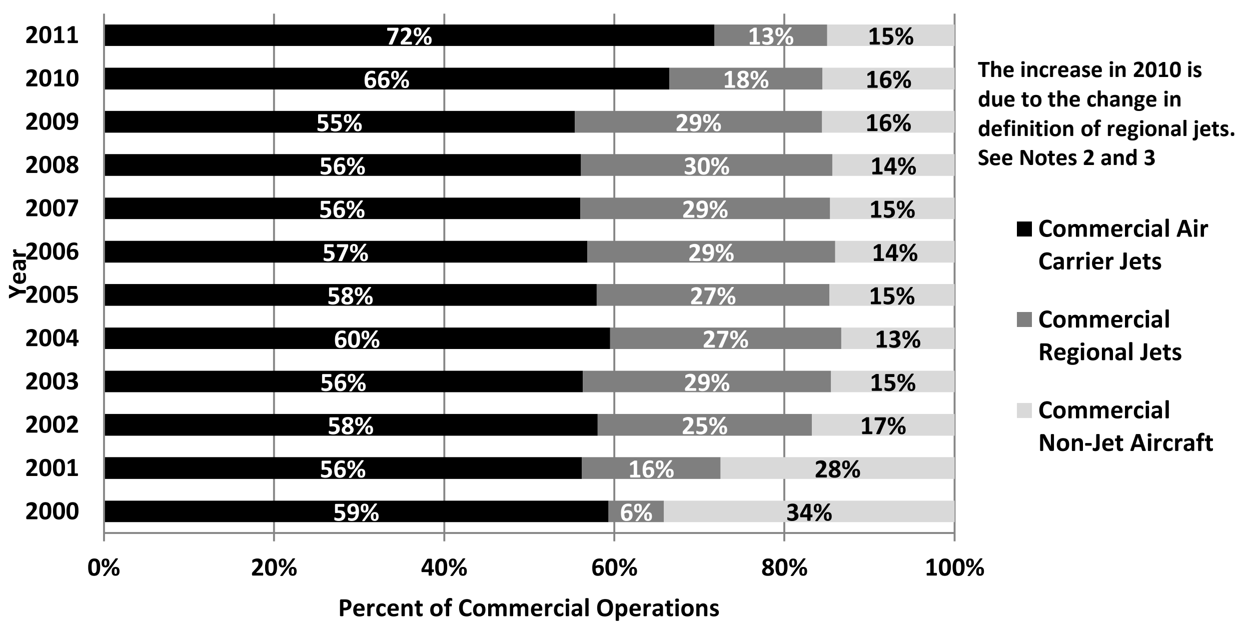
14 Some of these are military types as well as older Stage 1 and 2 airplanes that no longer operate in the U.S. or do not operate at Logan Airport. There are ordinarily no military aircraft operations at Logan Airport.

of operations by categories of aircraft operating at Logan Airport in 2011 and includes similar data for 2010 and prior years back to 2000. Data prior to 2000 are included in *Appendix H, Noise Abatement*.

Commercial Operations

Regional jets (RJs) are defined as those aircraft with 90 or less seats, consistent with the categorization in *Chapter 2, Activity Levels*.[15] For years prior to 2010, the RJs in this chapter were classified as aircraft with less than 100 seats. When RJs first started gaining popularity, the aircraft types available were typically 50 seats or less with the traditional air carrier jet being 100 seats and higher. As newer aircraft types have become available, the smaller 35 to 50 seat types have been replaced by 70 to 99-seat types, with the 90 and above seat types flying many of the traditional air carrier routes. The majority of the newer types fall into two categories: the 70 to 75-seat category which remain categorized as RJs, and the 91 to 99-seat category which are categorized as air carrier jets. The redefinition of the popular Embraer 190 at Logan Airport results in the increase of modeled air carrier jets to 66 percent in 2010 and 72 percent in 2011.[16] The air carrier jet increase was almost entirely offset by the decrease in RJs with all commercial jets increasing to 85 percent overall in 2011 (a 1 percent increase from 2010). Non-jet commercial operations decreased slightly at 15 percent of the overall commercial fleet. This change in definition of some of the commercial jet types does not affect the noise modeling results, simply how the attribution of noise sources are reported in the tables. Figure 6-1 presents the commercial operations groups in terms of percent of the total for each year. Figure 6-1 also shows the decrease in commercial non-jet operations after 2000 (34 percent of the fleet) and the rise of RJs, which were just 6 percent of the fleet in 2000 and increased to almost 30 percent of the fleet between 2003 to 2009.

Figure 6-1 Fleet Mix of Commercial Operations (Passenger and Cargo) at Logan Airport



Source: HMMH, 2011.
1 Includes both passenger and cargo operations.
2 After 2009, the split between Air Carrier Jets and RJs is 90 seats with RJs having less than 90 seats.
3 Prior to 2010, the split between Air Carrier Jets and RJs is 100 seats with RJs having less than 100 seats.

15 United States Code, 2006 Edition, Supplement 3, Title 49 – Transportation Subtitle VII – Aviation Programs Part A – Air Commerce and Safety, Subpart II, Economic Regulation, Chapter 417 - Operations or Carriers, Subchapter III - Regional Air Service Incentive Program, Sec. 41762 – Definitions – defines regional jet air carrier service to be aircraft with a maximum of 75 seats. Therefore, this *2011 ESPR* categorizes aircraft with 70-75 seats and below as regional jets and aircraft with 90 seats and higher aircraft as air carrier (Note: there are no types with 75 to 90 seats).

16 The CRJ-900 was identified as having over 90 seats in the *2010 EDR*, which has been corrected in this *2011 ESPR*.

Compared to 2010, the number of average daily operations (Table 6-1) indicates a modest increase in air carrier activity, with overall commercial traffic increasing by 0.8 percent in 2011. The continued shift of operations away from the smaller RJ aircraft continued in 2011 with an increase of 54.6 modeled operations per day and a large decrease in modeled RJ operations by 43.2 operations per day. However, the increase in air carrier jets was almost entirely offset by the decrease in RJs. The total commercial jet increase from 2010 to 2011 is 11.4 operations per day. Non-jet commercial operations decreased by 3.8 operations per day to almost 140 per day. Nighttime commercial operations (between 10:00 PM and 7:00 AM) in 2011 increased by 0.9 percent compared to 2010. Overall, commercial operations are still recovering from the 2008/2009 Economic Recession.

General Aviation Operations

Modeled GA activity exhibited a 92.5 percent increase, from approximately 40 daily operations in 2010 to 77 daily operations in 2011 (Table 6-1). Use of Stage 2 GA jets decreased to less than 30 operations per year and use of Stage 3 GA jets increased by 86.6 percent. Non-jet GA activity levels in 2011 increased 118.4 percent compared to 2010. Overall GA nighttime operations increased by 67.5 percent, from 4.0 operations per night in 2010 to 6.6 per night in 2011. However, this comparison should be put into context: GA operations in 2009 and 2010 were at a historic lows. Although the overall increase in GA activity compared to 2010 may seem large from a historical perspective, 2011 GA operations were similar to 2007 and demonstrate a return to levels prior to the economic downturn. Nighttime GA operations also increased but remained a smaller percentage of the GA total than prior years (Nighttime GA operations were 9.9 percent of the total in 2010 and dropped to 8.6 percent of the total in 2011). Data prior to 2000 are included in *Appendix H, Noise Abatement.*

Table 6-1 Modeled Average Daily Operations by Commercial and General Aviation Aircraft[1]

		2000[3]	2001[3]	2002[3]	2003[3]	2004[3]	2005[3]
Commercial Aircraft							
Stage 2 Jets[5]	Day	5.13	1.18	0.05	0.08	0.03	0.05
	Night	0.26	0.05	0.00	0.00	0.01	0.01
	Total	**5.39**	**1.23**	**0,05**	**0.08**	**0.04**	**0.06**
Stage 3 Jets (All)	Day	727.09	756.24	740.75	717.85	772.39	765.76
	Night	103.66	109.77	97.04	92.69	113.24	113.66
	Total	**830.75**	**866.01**	**837.79**	**810.54**	**885.63**	**879.42**
Air Carrier Jets	Day	648.95	569.99	500.70	461.06	518.96	505.48
	Night	99.79	101.30	83.52	72.69	89.24	91.99
	Total	**748.74**	**671.29**	**584.22**	**533.75**	**608.20**	**597.47**
Regional Jets	Day	78.14	186.25	240.05	256.80	253.43	260.34
	Night	3.87	8.47	13.52	19.99	24.00	21.68
	Total	**82.01**	**194.72**	**253.57**	**276.79**	**277.43**	**282.01**
Non-Jet Aircraft	Day	409.62	317.62	165.45	135.18	133.24	148.77
	Night	21.58	10.97	3.45	2.41	3.03	3.02
	Total	**431.20**	**328.58**	**168.89**	**137.59**	**136.28**	**151.79**
Total Commercial	Day	1,141.84	1,075.04	906.25	853.10	905.66	914.59
Operations	Night	125.51	120.79	100.49	95.10	116.29	116.68
	Total	**1,267.35**	**1,195.82**	**1,006.73**	**948.20**	**1021.95**	**1031.27**
GA Aircraft							
Stage 2 Jets[5]	Day	7.29	5.15	3.65	2.84	0.94	2.29
	Night	0.64	.50	0.41	0.26	0.14	0.25
	Total	**7.93**	**5.65**	**4.08**	**3.10**	**1.08**	**2.54**
Stage 3 Jets	Day	40.08	34.23	37.83	46.21	53.72	58.84
	Night	3.21	3.28	6.42	6.98	8.37	9.33
	Total	**43.29**	**37.51**	**44.25**	**53.19**	**62.09**	**68.16**
Non-Jets	Day	34.57	37.31	17.36	17.81	16.95	14.00
	Night	1.83	1.92	4.45	4.40	5.20	4.75
	Total	**36.40**	**39.23**	**21.81**	**22.21**	**22.14**	**18.75**
Total GA	Day	81.94	76.68	58.84	66.88	71.60	75.12
Operations	Night	5.68	5.71	11.29	11.64	13.71	14.33
	Total	**87.62**	**82.39**	**70.13**	**78.52**	**85.31**	**89.46**
Total	Day	1,223.78	1,151.72	965.09	919.98	977.27	989.71
	Night	131.19	126.50	11.78	106.74	130.00	131.02
	Total[3]	**1,354.97**	**1,278.21**	**1,076.86**	**1,026.72**	**1,107.07**	**1120.73**

Table 6-1 Modeled Average Daily Operations by Commercial and General Aviation Aircraft[1] (Continued)

		2006[3]	2007[3]	2008[3]	2009[3]	2010[2]	2011[2]
Commercial Aircraft							
Stage 2 Jets[4]	Day	0.03	0.03	0.01	0.00	0.01	0.01
	Night	0.00	0.01	0.01	0.00	0.01	0.00
	Total	**0.03**	**0.04**	**0.02**	**0.00**	**0.02**	**0.01**
Stage 3 Jets (All)	Day	767.55	748.13	699.39	667.45	674.25	684.19
	Night	114.81	118.29	114.30	103.05	107.92	109.38
	Total	**882.36**	**866.42**	**813.69**	**770.50**	**782.17**	**793.57**
Air Carrier Jets	Day	490.63	472.39	443.15	422.92	521.64	571.03
	Night	92.71	96.28	89.89	82.21	93.98	99.17
	Total	**583.34**	**568.66**	**533.04**	**505.14**	**615.62**	**670.20**
Regional Jets	Day	276.95	275.77	256.24	244.53	152.61	113.16
	Night	22.11	22.03	24.40	20.84	13.94	10.21
	Total	**299.06**	**297.80**	**280.64**	**265.37**	**166.55**	**123.37**
Non-Jet Aircraft	Day	140.81	145.27	132.52	136.43	138.53	135.18
	Night	3.26	3.47	4.00	5.56	5.21	4.73
	Total	**144.07**	**148.73**	**136.52**	**141.99**	**143.74**	**139.91**
Total Commercial	Day	908.41	893.43	831.92	803.88	812.78	819.39
Operations	Night	118.09	121.77	118.31	108.62	113.13	114.11
	Total	**1026.51**	**1015.19**	**950.23**	**912.50**	**925.91**	**933.50**
GA Aircraft							
Stage 2 Jets[4]	Day	1.90	1.24	0.36	0.09	0.27	0.08
	Night	0.17	0.19	0.03	0.01	0.04	0.00
	Total	**2.07**	**1.43**	**0.38**	**0.10**	**0.30**	**0.08**
Stage 3 Jets	Day	61.08	54.82	43.98	22.18	27.80	52.51
	Night	6.57	6.39	4.52	2.33	3.21	5.35
	Total	**67.65**	**61.21**	**48.49**	**24.51**	**31.01**	**57.87**
Non-Jets	Day	15.05	11.98	15.13	8.19	8.19	18.18
	Night	1.39	3.61	1.08	0.75	0.72	1.29
	Total	**16.44**	**15.58**	**16.20**	**8.93**	**8.92**	**19.48**
Total GA	Day	78.03	68.04	59.46	30.46	36.26	70.78
Operations	Night	8.13	10.19	5.62	3.08	3.97	6.65
	Total	**86.15**	**78.22**	**65.08**	**33.54**	**40.22**	**77.43**
Total	Day	986.43	961.46	891.39	834.33	849.03	890.16
	Night	126.22	131.96	123.93	111.70	117.10	120.76
	Total[3]	**1112.66**	**1093.42**	**1015.31**	**946.03**	**966.13**	**1010.92**

Source: Massport's Noise Monitoring System, Revenue Office numbers, HMMH 2011.

1 Operations include scheduled and unscheduled operations and data for years prior to 2000 is available in *Appendix H, Noise Abatement*.

2 After 2010, the split between Air Carrier Jets and RJs is 90 seats with RJs having less than 90 seats.

3 Prior to 2010, the split between Air Carrier Jets and RJs is 100 seats with RJs having less than 100 seats.

4 Stage 2 aircraft are exempt from meeting newer federal Stage 3 noise limits when their certificated maximum gross takeoff weight (MGTOW) is less than or equal to 75,000 pounds.

Stage 2, Stage 3, and Stage 4 Jet Aircraft

Jet aircraft currently operating at Logan Airport are categorized by FAA into the three groups: Stage 2, Stage 3, and Stage 4. As described previously, the designation refers to a noise classification specified in FAR Part 36 that sets noise emission standards based on an aircraft's maximum certificated weight. Generally, the heavier the aircraft, the more noise it is permitted to make within the limits set established by FAR Part 36.

The *ANCA of 1990* required operators of Stage 2 airplanes weighing more than 75,000 pounds to transition to Stage 3 aircraft by phasing out the older, noisier airplanes by December 31, 1999. Stage 2 aircraft weighing less than or equal to 75,000 pounds (most of them used in GA or for small commercial activities such as transporting checks between Federal Reserve Banks) are exempt from the phase-out deadline and have continued to fly after December 31, 1999.

Stage 4 aircraft are currently being added to the airlines' fleets as airlines add new aircraft. The new Stage 4 noise standard applies to any new jet aircraft type designs over 12,500 pounds requiring FAA approval after January 1, 2006. The International Civil Aviation Organization (ICAO) has already adopted a similar regulation for international operators, but neither the FAA nor ICAO have indicated there will be restrictions on the remaining recertificated Stage 3 aircraft from carrier fleets. Because of the noise differences between Stage 2, recertificated Stage 3, Stage 3 aircraft, and aircraft that meet Stage 4 requirements, Massport tracks operations by these categories to follow their trends. Table 6-2 provides the percentage of commercial jet operations by stage since 2000. As noted by Table 6-2, the majority of the commercial jet fleet at Logan Airport meets Stage 4 requirements. Certificated Stage 3 aircraft as a percentage of the commercial jet fleet increased compared to 2010 accounting for 99.5 percent of the commercial jet fleet in 2011.

Table 6-2 Percentage of Commercial Jet Operations by Part 36 Stage Category[1]

Year	Stage 4 Requirements[2]	Certificated Stage 3	Recertificated Stage 3[4]	Stage 2 Greater than 75,000 lbs.	Total
2000	NA	75.0%	24.0%	1.0%	100%
2001	NA	86.3%	13.6	0.1%	100%
2002	NA	92.8%	7.2%	0.0%	100%
2003	NA	85.8%	4.1%	0.0%	100%
2004	NA	97.8%	2.2%	0.0%	100%
2005	NA	98.0%	2.0%	0.0%	100%
2006	-	98.6%	1.4%	0.0%	100%
2007	-	98.9%	1.1%	0.0%	100%
2008	-	99.1%	0.9%	0.0%	100%
2009	87.8%[3]	99.1%[3]	0.9%	0.0%	100%
2010	93.2%[3]	98.9%[3]	1.1%[5]	0.0%	100%
2011	95.5%[3]	99.5%[3]	0.5%	0.0%	100%

Source: Massport's Noise Monitoring System, Revenue Office numbers, HMMH 2011.

1 Data for years prior to 2000 is available in *Appendix H, Noise Abatement.*

2 Aircraft that meet Stage 4 requirements are aircraft which are certificated Stage 4 or would qualify if recertificated. Certificated Stage 4 aircraft were not available until 2006 and the level of aircraft that meet Stage 4 requirements has not been determined for 2006 through 2008.

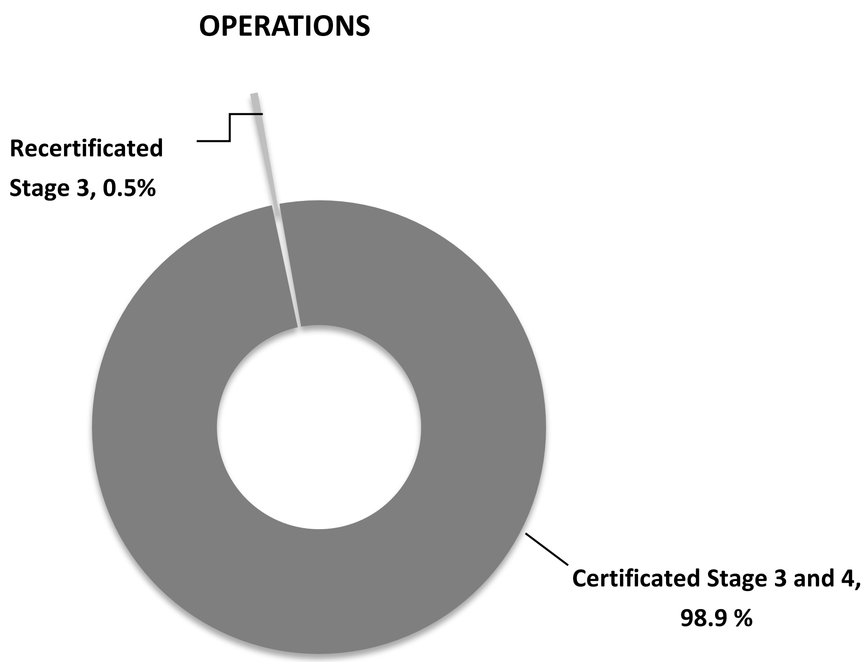
3 All aircraft listed as meeting Stage 4 requirements are also listed as Stage 3 aircraft.

4 Recertificated Stage 3 aircraft are aircraft originally manufactured as a certificated Stage 1 or 2 aircraft under FAR Part 36 which have been either retrofitted with hushkits or have been re-engined to meet Stage 3 requirements.

5 Only three commercial carriers, with more than 100 annual operations, continue to use recertificated Stage 3 aircraft at Logan Airport (Delta Air Lines, Capital Cargo International, FedEx). A few charter operators also use these aircraft.

Figure 6-2 shows the relative contributions of these aircraft groups to total commercial operations at Logan Airport compared to their contribution to total noise. The comparison illustrates the stronger than average influence that recertificated aircraft have on noise exposure, accounting for almost 0.5 percent of the commercial jet operations but creating approximately 1.1 percent of the noise exposure.

Figure 6-2 Relative Contributions of Commercial Jet Operations at Logan Airport, 2011



Source: Massport, HMMH Analysis 2011
Notes: Includes only jet operations
Recertificated Stage 3 includes aircraft that were original manufactured as Stage 1 or 2 aircraft and then modified to and re-certificated to meet Stage 3
Certificated Stage 3 & 4 includes aircraft that were originally manufactured certificated to meet Stage 3 or Stage 4.
Stage 2 operations contribute less than 0.1 percent of operations.

Nighttime Operations

Although Stage 2 aircraft over 75,000 pounds have been banned since January 1, 2000, aircraft certificated as Stage 2, which weigh less than 75,000 pounds, have continued to operate in the U.S. Stage 2 aircraft currently allowed to operate are small corporate jet aircraft that are primarily in the GA fleet. However, the final FAA reauthorization bill includes a phase-out of these types of operations by December 31, 2015. Logan Airport's Noise Rules prohibit Stage 2 aircraft of less than 75,000 pounds from using the Airport between the hours of 11:00 PM and 7:00 AM. Massport's PREFLIGHT™ system[17] alerts Noise Office staff of potential non-compliant flights when they occur. The Noise Office staff review these reports and can investigate the potential non-compliant flights. These violations are usually flight exempt from the Noise Rules such as medical or emergency flights. PREFLIGHT™ software is used to assist in compiling fleet, day/night splits, and runway use information from Massport's Passive Surveillance Radar System (PASSUR) radar data. This data is used as a secondary source to the International Telephone & Telegraph (ITT Excelis) Airscene NOMS, which is the Noise Office's primary source of data.

17 PREFLIGHT is the prior Flight track processing system which is still operating using PASSUR radar data.

In addition, Massport monitors flights that operate between the broader DNL nighttime periods of 10:00 PM to 7:00 AM, when each flight is penalized 10 dB in calculations of noise exposure. Table 6-3 shows this nighttime activity by different groups of aircraft. Nighttime flights by commercial jet operations increased by 1.3 percent from 107.9 operations per night in 2010 to 109.4 operations per night in 2011 and nighttime flights by commercial non-jet operators decreased by 0.5 percent from 5.2 operations per night in 2010 to 4.7 operations per night in 2011, but were still the second lowest since 2005. Nighttime GA operations rose 67.5 percent. These changes resulted in an overall increase in nighttime operations of 3.1 percent in 2011. The majority of nighttime operations (between 10:00 PM and 7:00 AM) occurred either before midnight or after 5:00 AM. These nighttime operations represent 11.9 percent of total operations at Logan Airport.

Table 6-3 Modeled Nighttime Operations (10:00 PM to 7:00 AM) at Logan Airport Per Night[1]

	Commercial Jets	Commercial Non-Jets	General Aviation[1]	Total
2000	103.92	21.58	5.68	131.19
2001	109.82	10.97	5.71	126.50
2002	97.04	3.45	11.29	111.78
2003	92.69	2.41	11.64	106.74
2004	113.26	3.03	13.73	130.02
2005	113.67	3.02	14.33	131.02
2006	114.81	3.26	8.13	126.22
2007	118.30	3.47	10.19	131.96
2008	114.31	4.00	5.62	123.93
2009	103.05	5.56	3.08	111.70
2010	107.93	5.21	3.97	117.10
2011	109.38	4.73	6.65	120.76
Change (2010 to 2011)	**1.45**	**(0.48)**	**2.68**	**3.66**
Percent Change	**1.34%**	**(9.21%)**	**67.51%**	**3.13%**

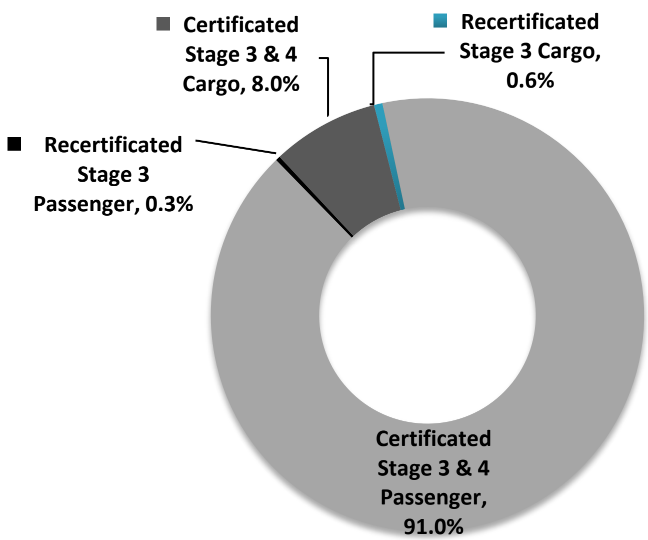
Source: Massport and International Telephone & Telegraph (ITT) radar data. HMMH, 2011.
1 Data for years prior to 2000 is available in *Appendix H, Noise Abatement*.

Figure 6-3 shows the nighttime jet commercial activity by air carrier and cargo operators and shows the following findings:

- Cargo operations accounted for 8.0 percent of all commercial nighttime operations in 2011.
- There was a small increase in overall in nighttime cargo flights which comprised 7.8 percent of the total commercial night operations in 2010, and in 2011 comprised 8.0 percent of the total. This small increase is due to the improved economy. This also resulted in a reduction in the share of passenger operations as part of total commercial nighttime flights which decreased from 92.2 percent in 2010 to 91.0 percent in 2011. For context, in 2000, the share of cargo jet operations comprised 18.4 percent of the total night operations while the share of passenger jet operations at night was only 81.6 percent.
- Flights by cargo operators using recertificated Stage 3 aircraft comprised 0.6 percent of the commercial nighttime activity compared to the 1.0 percent reported for 2010 and 8 percent in the 2000.
- Even though there was an increase in night operations in passenger aircraft operations in 2011, passenger airlines flew only 0.3 percent of total night commercial jet operations in recertificated Stage 3 aircraft compared to 0.6 percent in 2010 and 13 percent in 2000.
- The continued reduction in the use of recertificated Stage 3 aircraft at night helped to offset the increase in overall jet operations at night on the noise environment.

Though ICAO and the FAA are not expected to require the phase-out of the remaining recertificated operations prevalent among cargo operators, the use of these aircraft will continue to decline in the future as these aging aircraft age and are taken out of service.

Figure 6-3 Commercial Nighttime Jet Operations Part 36 Stage Breakdown, 2011

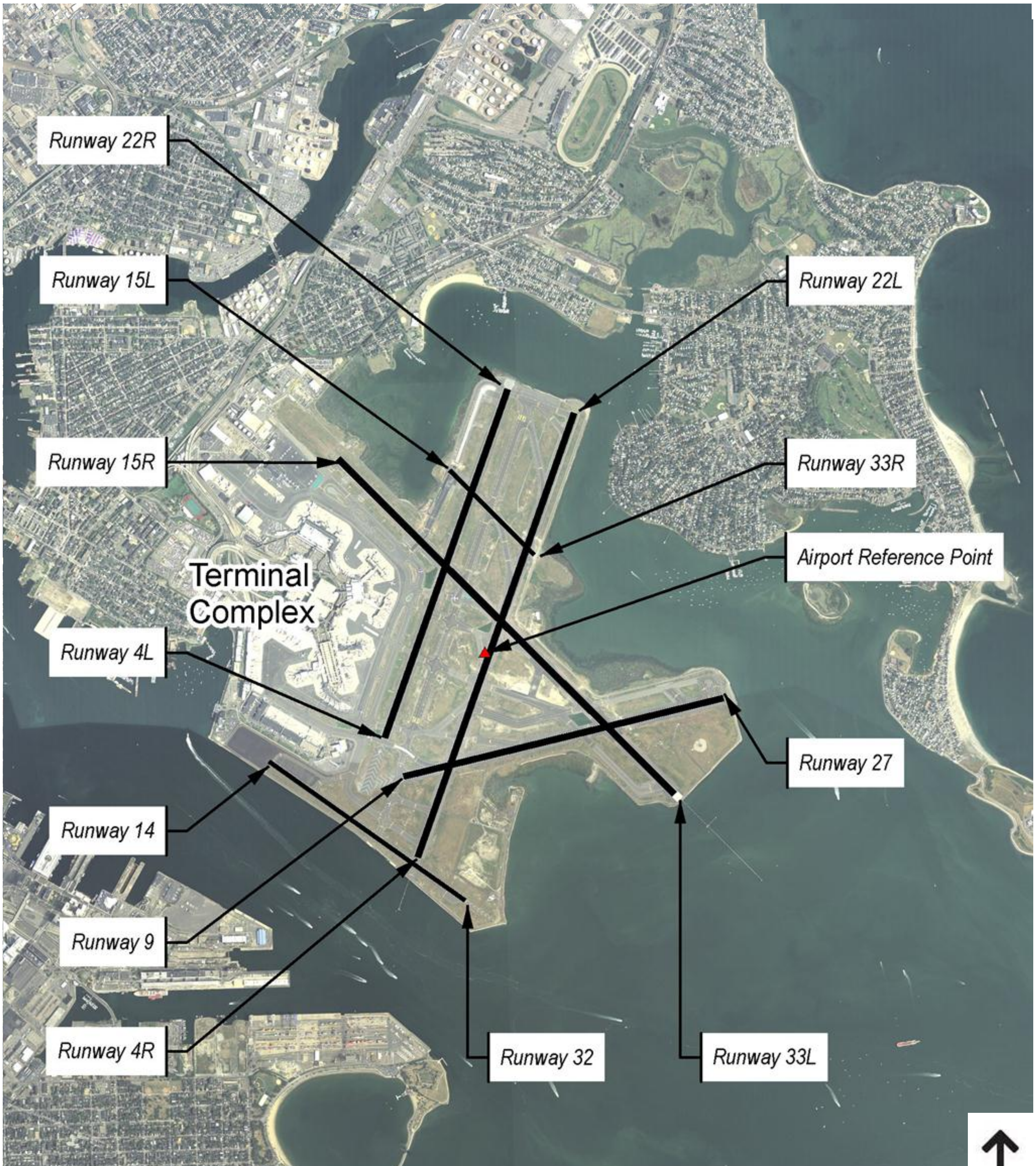


Source: Massport, HMMH Analysis, 2011.
Notes: Recertificated Stage 3 includes aircraft that were original manufactured as Stage 1 or 2 aircraft and then modified to and re-certificated to meet Stage 3 requirements. Certificated Stage 3 & 4 includes aircraft that were originally manufactured certificated to meet Stage 3 or Stage 4.
Stage 2 Night operations contribute less than 0.1 percent of operations.
Noise calculations include the 10 dB nighttime penalty.

Runway Use

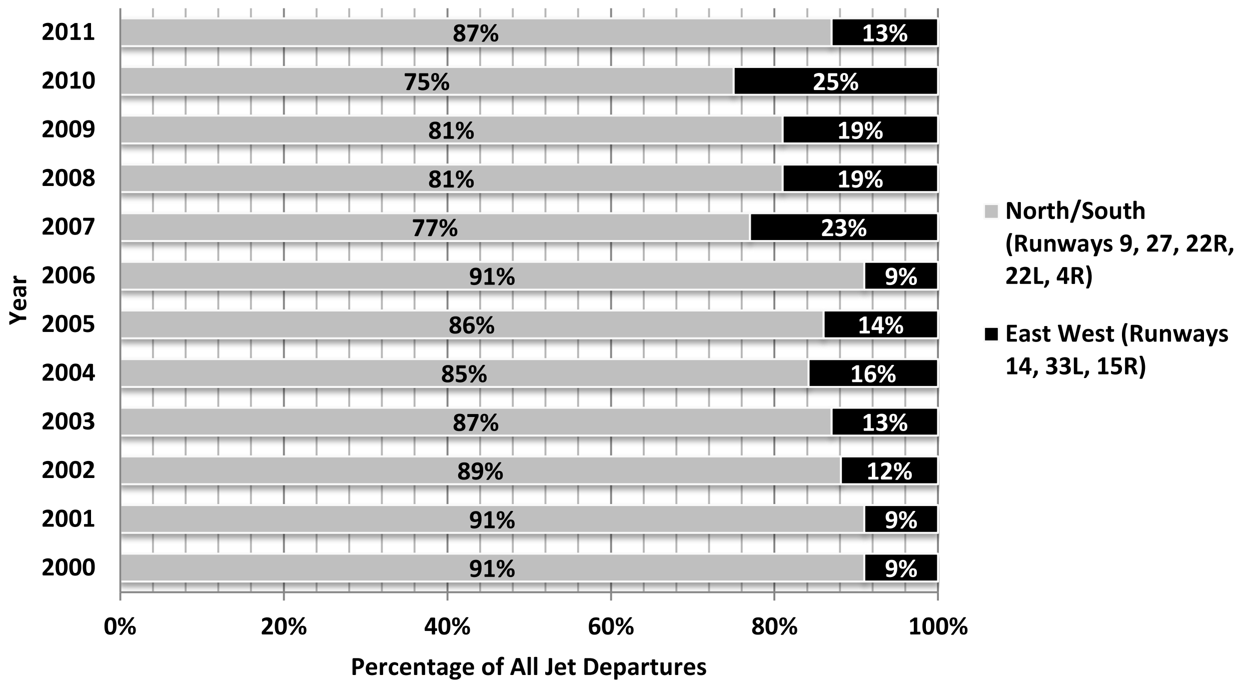
Logan Airport's runways and the Centerfield Taxiway are shown in Figure 6-4. The Centerfield Taxiway runs parallel to and between Runways 4L-22R and 4R-22L and is designed to improve efficiency at the Airport. Runway use refers to the frequency of which aircraft utilize each of these runways during the course of the year, as dictated or permitted by availability, wind, weather, aircraft performance, demand, and air traffic control conditions. Runway 15R-33L and Runway 4R-22L are Logan Airport's longest runways; each is just over 10,000 feet in length. Runway 15R-33L is the preferred runway at night, with arrivals to Runway 33L and departures from Runway 15R, thus keeping flights over Boston Harbor. Runway 22R is used primarily for departures, and Runway 22L is used primarily for arrivals. Runway 9 is used for departures, and Runways 15R, 27, and 33L are used for both arrivals and departures. Runway 14-32 is unidirectional; there are no arrivals to Runway 14 and no departures from Runway 32. Additionally, Runway 14-32 can be used only during northwest wind conditions when winds are 10 knots or greater. Under certain northwest wind conditions, Runway 32 provides the FAA with a second arrival runway, thereby reducing delays at the Airport. Runway 14 is available for departures but is rarely used. Also shown on Figure 6-4, is the Airport Reference Point (ARP), which is the geographic center of all of the runway ends and is used to determine the distances to the noise monitoring terminals in this *2011 ESPR*.

Figure 6-4 Logan Airport Runways



Source: HMMH, Inc. 2011, U.S. Department of Agriculture, National Agriculture Imagery Program (NAIP), 2010.

Figure 6-5 Jet Departures by Operating Direction



Source: Massport ITT data, HMMH 2011 Analysis.
Note: Runway 14-32 is unidirectional with no arrivals to Runway 14 and no departures from Runway 32.

Figure 6-5 shows the operating direction for all jet departures, which shows that Logan Airport continues to be characterized by a north-south operating flow. Table 6-4 presents consolidated annual runway use by jets. Runway use conditions in 2011 were as follows:

- The average use of the north-south flow is 80.2 percent since the opening of Runway 14-32.
- Jet aircraft departures used a north-south flow 87 percent of the time, a 12 percent increase compared to 2010 (and the prior three years) as shown in Figure 6-5. This is mainly due to the Runway 15R-33L closure during 2011.
- Combined arrivals to Runways 4L and 4R increased by 11 percent to 44 percent in use in 2011 compared to 2010. Departures from Runway 4R increased by 2 percent from 2010.
- Arrivals to Runway 22L increased by 1 percent in 2011 with departures remaining at 2 percent. Runway 22R departures increased by 5 percent to 36 percent. Runways 22R and 9 remained consistently the most used departure runways at Logan Airport.
- Departures on Runway 27 decreased by 3 percent to 7 percent in 2011, and departures on Runway 9 increased 8 percent to 36 percent in 2011. Arrivals to Runway 27 decreased from 32 percent in 2010 to 28 percent in 2011.
- Since opening in late November 2006, Runway 14-32 was used primarily for arrivals of RJs and turboprops over Boston Harbor, accounting for one percent of annual jet arrivals, which is the same as in 2010.
- Runway 15R-33L was closed for three months during 2011 for the construction of the Runway 33L RSA improvements, which resulted in decreases in departures and arrivals on Runway 33L and Runway 15R compared to 2010.

Table 6-4 Summary of Annual Jet Aircraft Runway Use[1]

	Runway									
	4L	4R	9	14[2]	15R	22L	22R	27	32[2]	33L
2000										
Departures	0%	8%	35%	NA	4%	3%	30%	15%	NA	6%
Arrivals	4%	40%	0%	NA	1%	7%	0%	28%	NA	20%
2001										
Departures	0%	7%	34%	NA	4%	3%	35%	12%	NA	5%
Arrivals	5%	36%	05	NA	1%	8%	0%	32%	NA	18%
2002										
Departures	0%	4%	31%	NA	6%	3%	35%	16%	NA	6%
Arrivals	6%	31%	0%	NA	1%	12%	0%	30%	NA	21%
2003										
Departures	0%	4%	33%	NA	7%	2%	34%	14%	NA	6%
Arrivals	7%	33%	0%	NA	1%	14%	0%	28%	NA	18%
2004										
Departures	0%	5%	34%	NA	10%	4%	24%	18%	NA	6%
Arrivals	6%	34%	05	NA	1%	12%	0%	24%	0%	23%
2005										
Departures	0%	5%	36%	NA	7%	1%	31%	13%	-	7%
Arrivals	8%	33%	0%	-	1%	11%	0%	29%	NA	17%
2006										
Departures	0%	4%	33%	<0.1%	3%	1%	40%	13%	-	6%
Arrivals	7%	29%	0%	-	1%	14%	0%	33%	0.2%	16%
2007										
Departures	0%	5%	31%	<0.1%	4%	1%	33%	7%	-	19%
Arrivals	5%	31%	0%	-	1%	15%	0%	36%	2%	11%
2008										
Departures	0%	6%	33%	<0.1%	3%	<0.1%	36%	6%	-	16%
Arrivals	6%	30%	0%	-	2%	17%	0%	33%	2%	11%
2009										
Departures	0%	7%	32%[3]	0%	3%	2%	34%	6%[3]	-	16%
Arrivals	7%	31%	0%[3]	-	3%	17%	0%	30%[3]	1%	11%
2010										
Departures	0%	4%	28%	<1%	8%	2%	31%	10%	-	17%
Arrivals	5%	28%	0%	-	1%	15%	0%	32%	1%	16%
2011										
Departures	0%	6%	36%	<1%	5%[4]	2%	36%	7%	-	7%[4]
Arrivals	7%	37%	0%	-	<1%[4]	16%	0%	28%	1%	11%[4]

Source: Massport Noise Office and HMMH, 2011.

Notes: The data reflect actual percentages of jet aircraft operations on each runway end. They should not be confused with effective runway use which is used by the Preferential Runway Advisory System (PRAS) to derive recommendations for use of a particular runway.
Jet aircraft are not able to use Runway 15L or 33R due to its length of only 2,557 feet.
Values may not add to 100 percent due to rounding.

1 Data for years prior to 2000 is available in *Appendix H, Noise Abatement.*
2 Runway 14-32 opened in late November, 2006. (Runway 14-32 is unidirectional with no arrivals to Runway 14 and no departures from Runway 32).
3 Runway 9-27 had extended weekend closings for resurfacing during 2009.
4 Runway 15R-33L was closed for 3 months in 2011.
NA Runway was not available.

Preferential Runway Advisory System (PRAS)

Developed in 1982 and enhanced in 1990 and subsequent years, the PRAS is a set of short-term and long-term runway use goals that include the use of a computer program that recommends to FAA air traffic controllers, runway configurations that will meet weather and demand requirements and provide an equitable distribution of Logan Airport's noise impacts on surrounding communities. The two primary objectives of the PRAS goals are to distribute noise in on an annual basis, and to provide short-term relief from continuous operations over the same neighborhoods at the ends of the runways.

In February of 2004, the FAA upgraded to the Standard Terminal Automation Replacement System (STARS) and Integrated Information Display & Dissemination System version 5 (IDS5)[18] radar during the consolidation of the Boston Terminal Control Center (TRACON) at the new facility in Merrimack, New Hampshire. As a result of this upgrade, a shutdown of the PRAS system computer was necessary. Updated PRAS software was installed in 2007. Technical difficulties related to processing input from the FAA's IDS5 system have continued. During Phase 2 of the on-going BLANS the Logan Airport Community Advisory Committee (CAC) voted to abandon PRAS because it had not achieved the intended noise abatement.[19] For this *2011 ESPR*, Massport will continue to present the annual comparison to the PRAS goals.

PRAS Compliance

Under the PRAS, each runway end has a specific annual utilization goal, defined separately for departures and arrivals. The goals are defined in terms of effective usage, which applies a factor of 10 to nighttime (10:00 PM to 7:00 AM) operations, equivalent to increasing nighttime exposure by 10 dB so that a change in effective utilization is roughly proportional to the change in DNL.

Table 6-5 provides a comparison of effective runway use in 2011 to that of 2010, and to the PRAS goals. The 2011 utilizations shown in bold indicate improvements toward the goals for all runways. The effective jet runway use in 2011 diverged from the PRAS goals, with the three month runway closure of Runway 15R-33L for the runway safety area improvements construction. None of the arrival percentages moved closer to the PRAS goals in 2011, however, departures for Runways 4L, 4R, 22L, 22R, and 33L moved closer to the PRAS goals. Due to the Runway 33L-15R, there was a large decrease in departure effective runway use and increased use of the parallel Runways 4L, 4R, 22L and 22R for departures.

The Effective Usage provided in the last ESPR in 2004 showed progress toward the PRAS goals on all runways and is provided in Table 6-5 for context. In 2011, arrivals to Runways 4L, 4R, 22L, and 22R are all greater than 2004 and the PRAS goals. Arrivals to Runways 15R, 27 and 33L are all lower than 2004 and the PRAS goals. Departures from Runways 22L and 22R are greater than in 2004 and greater than the PRAS goals whereas departures from Runways 4L, 4R, 15R, and 33L are greater than in 2004 but less than the PRAS goals. Departures from Runway 9 are slightly less than in 2004 and greater than the PRAS goals with departures from Runway 27 much less than in 2004 which was equal to the PRAS goal.

18 Standard Terminal Automation Replacement System (STARS) is FAA's replacement radar equipment and software for terminal approach control (TRACON) and tower facilities. Integrated Information Display & Dissemination System version 5 (IDS5) is an advanced information management toolset designed for air traffic control by Systems Atlanta, which works with the STARS system.

19 Boston Logan Airport Noise Study Level 3 Screening Analysis, FAA, December 2012, Page E-2

Table 6-5 Effective Jet Aircraft Runway Use in Comparison to PRAS Goals

	PRAS Effective Usage Goals		2004 Effective Usage		2010 Effective Usage		2011 Effective Usage	
Runway End	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
4R/L	21.1%	5.6%	**32.9%**	**4.0%**	**26.9%**	3.6%	36.0%	**5.5%**
9	0.0%	13.3%	**0.0%**	**29.0%**	0.0%	**20.4%**	0.0%	28.8%
15R	8.4%	23.3%	**1.1%**	**15.4%**	1.2%	**24.1%**	0.2%	16.1%
22L/R	6.5%	28.0%	**15.4%**	**26.4%**	22.0%	**25.2%**	26.1%	**32.6%**
27	21.7%	17.9%	**21.8%**	**17.9%**	20.4%	**11.8%**	19.5%	7.5%
33L	42.3%	11.9%	**28.9%**	**7.3%**	**28.9%**	**14.9%**	17.9%	**9.4%**
14[1]	NA	NA	-	-	-	<0.1%	-	<0.1%
32[1]	NA	NA	-	-	0.6%	-	0.3%	-

Source: Massport Noise Office and HMMH, 2011.
Notes: PRAS goals are stated in terms of effective jet operations which exclude non-jet flights, but which multiply each nighttime (10:00 PM to 7:00 AM) operation by a factor of 10. PRAS goals have not yet been established for Runways 14 and 32.
Bold text indicates runways use which is closer to PRAS goals.
1 Runway 14-32 opened in late November, 2006. (Runway 14-32 is unidirectional with no arrivals to Runway 14 and no departures from Runway 32).

Flight Tracks

As described in the Methodology section, Massport continued to use the pair of software packages known as RealProfiles™ and RealContours™. *Appendix H, Noise Abatement* provides a summary discussion of RealProfiles™ and RealContours™ and the *2004 ESPR* described the software in greater detail, and compared the results between the new software and typical modeling. The software package RealContours™ is used to develop the INM inputs based on available radar track. Instead of using representative model tracks, RealContours™ converts each radar track to an INM model track and then models the scaled operation on that track.[20] This allows Massport to take into account runway closures and/or temporary or permanent airspace changes which occur during the year.

For the *2011 ESPR*, 350,343 flight tracks were modeled to calculate the noise levels surrounding Logan Airport. Figures 6-6 through 6-12 provide a representative sample of flight tracks used with RealContours™ to develop the 2011 contours.[21] The figures show arrivals and departures separately for each of three aircraft categories: air carrier jets, RJs, and non-jets. The following figures are from April 2011, when the runway use was similar to the 2011 yearly average presented previously. Additional figures, and associated text, at the end of this chapter describe the RNAV[22] Standard Instrument Departure Procedures (SIDS) changes that were in effect at the end of 2011.

- Figure 6-6 displays air carrier jet departures following the recommended departure routes. The RNAV departure procedures are evident in this graphic as the departures from Runways 4R, 22R, 27 and 9 do not show the dispersion that has been evident in prior years. The dispersion of departures passing over Nahant has narrowed compared to 2010 and also over the Boston Harbor islands. However, departures from Runway 22R also follow a more defined turn pattern which passes more aircraft closer to the west

20 This method provides a one to-one correspondence of radar tracks to model tracks and ensures that the lateral and vertical dispersion of aircraft types are consistent with the radar data.
21 Runway use from each month was developed and compared to the annual runway use information. April 2011 provided the closest match to annual results.
22 aRea NAVigation (RNAV) - RNAV enables aircraft to fly on any desired flight path within the coverage of ground- or spaced-based navigation aids, or within the limits of the capability of aircraft self-contained systems, or a combination of both capabilities.

side of Pleasure Bay in South Boston compared to 2010. Massport has evaluated this change and the report is provided in *Appendix H, Noise Abatement*

- Figure 6-7 displays air carrier jet arrivals. This graphic displays the east downwind configuration which the air carrier arrivals utilize to line up on final approach to the runways thus avoiding populated areas to the west of the Airport.
- Figure 6-8 displays the RJ departures following the recommended departure routes with flights remaining north of the Hull peninsula and passing over the Nahant Causeway.
- Figure 6-9 displays the RJ arrivals which utilize both east and west sides of the Airport for arrivals. Arrivals to Runway 32 are also displayed on this graphic.
- Figure 6-10 displays the non-jet departures which tend to turn early off the runways and do not follow the jet departure routes. Non-jet departures from Runways 4L, 22R, 33L, and 27 are allowed to turn over populated areas whereas the jet aircraft are not. This also keeps the non-jet aircraft out of the jet departure paths allowing for efficient jet departures. RNAV equipped turboprops follow the Runway 22R departure procedure, as shown in the graphic.
- Figure 6-11 displays the non-jet arrivals and includes the Boston Harbor route for non-jet aircraft arriving to Runway 4L. The graphic also displays the non-jet arrivals to Runways 22R and 33R in addition to the other runways which also accommodate jets.
- Figure 6-12 displays the night jet arrivals using the Light Visual Approach to Runway 33L during the sample period. These flights remain offshore and avoid overflying Cohasset and Hull at night. Flights arriving to Runway 33L from the west pass over Saugus and Nahant at a higher altitude and then head south over the Boston Harbor to intersect with the visual approach procedure.

Meteorological Data

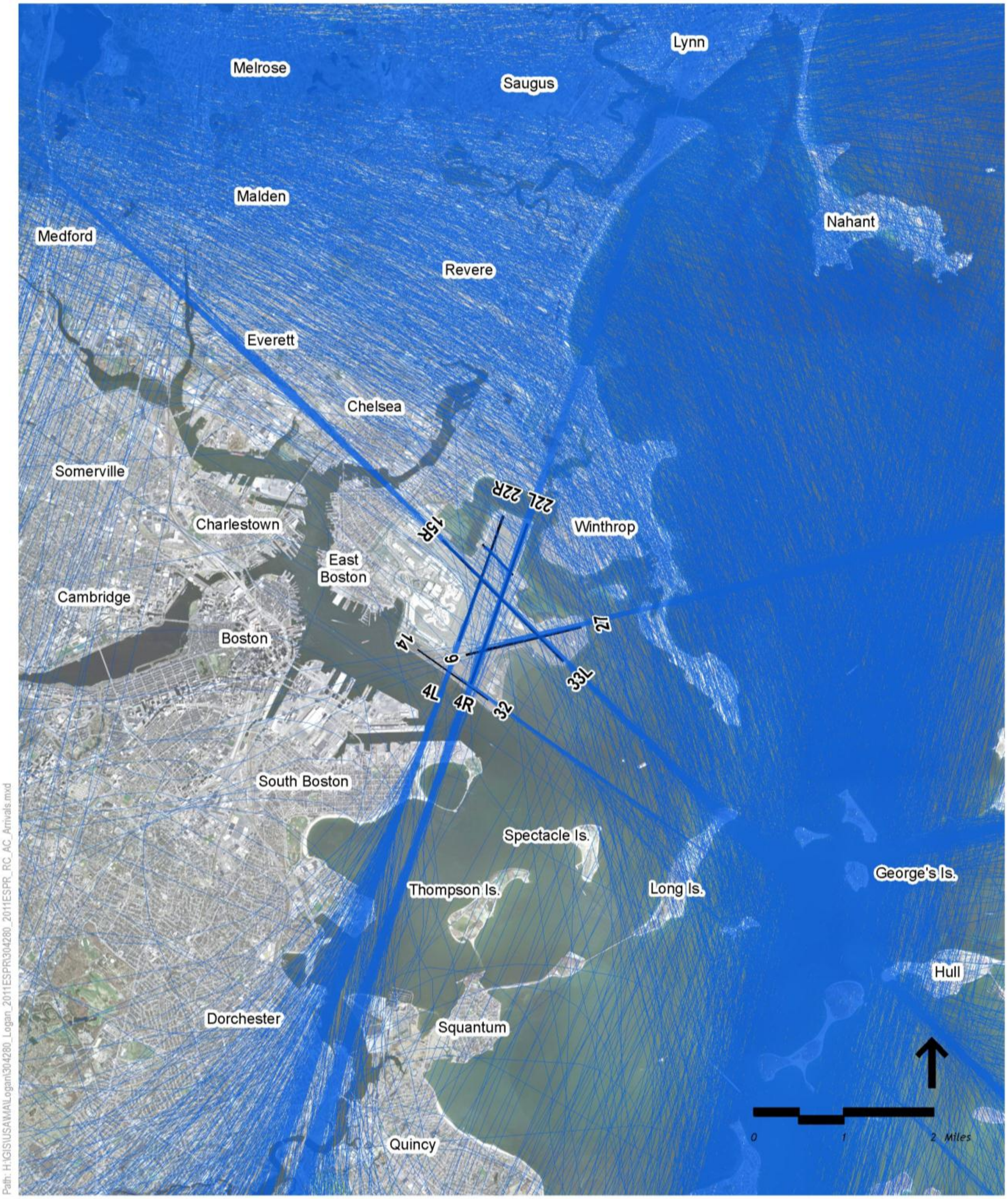
The INM has several settings that reflect aircraft performance profiles and sound propagation based on meteorological data. Meteorological settings include average temperature, barometric pressure, and relative humidity at the Airport. Massport obtained weather data for 2011 from the National Climatic Data Center (NCDC). Average daily values for each of the settings were used in the development of the 2011 noise conditions. The average conditions for each day allowed the modeling system used by Massport to develop performance profiles based on each day's conditions and allowed the INM model to use each day's conditions to assess the propagation of noise. This is an improvement in modeling over previous years (prior to 2008) which only used the annual average value to model these conditions. This improvement allowed the INM to better model aircraft profiles on days significantly different than the average such as during the winter and summer months.

Source: Massport NOMS / ERA Multi-Lat, MassGIS, USDA NAIP 2010

RealContours™ Air Carrier Jet Departure Tracks (April 2011)

Figure 6-6

Departure Flight Tracks



Source: Massport NOMS / ERA Multi-Lat, MassGIS, USDA NAIP 2010

RealContours™ Air Carrier Jet Arrival Tracks (April 2011)

Figure 6-7

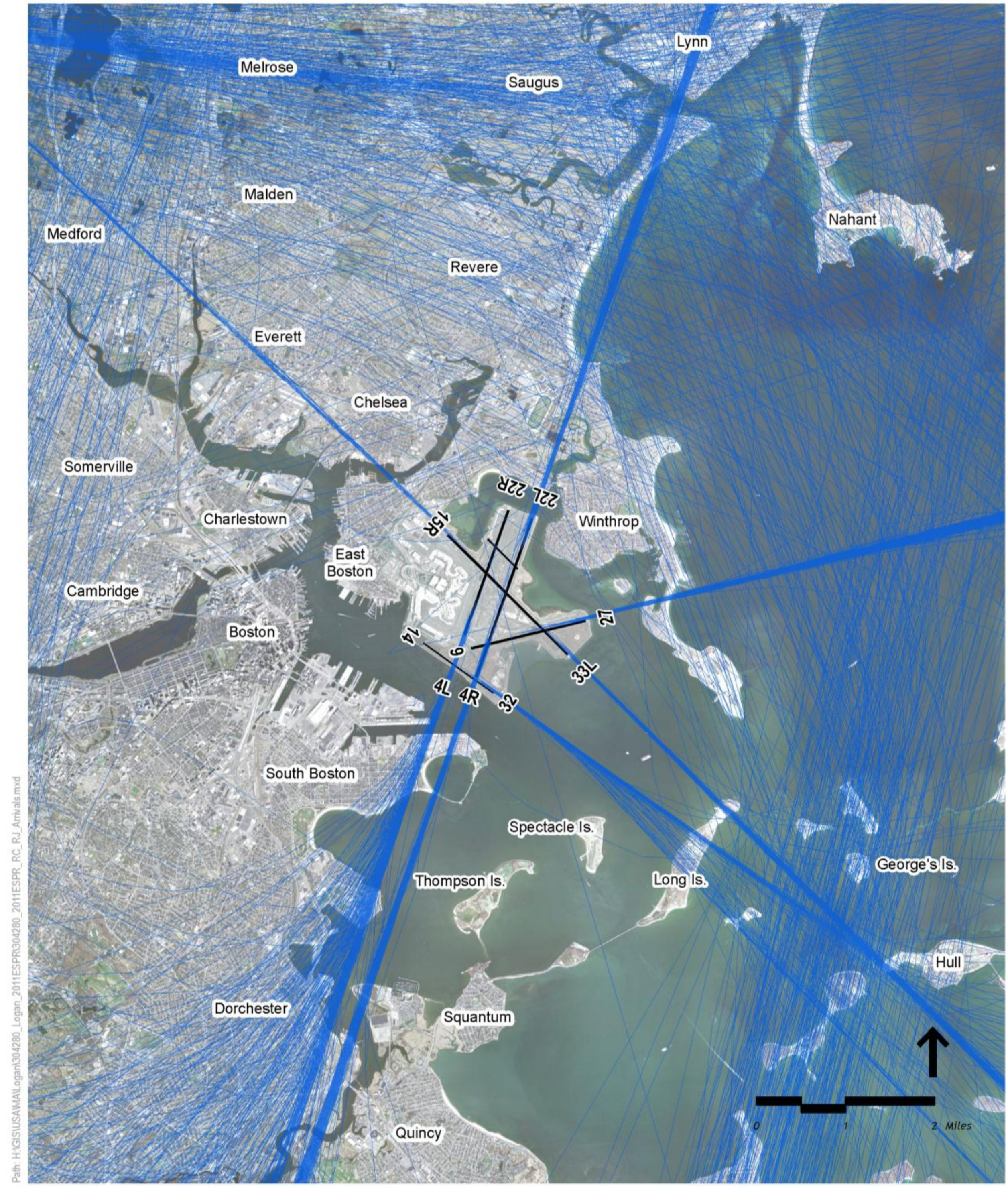
Arrival Flight Tracks

Source: Massport NOMS / ERA Multi-Lat, MassGIS, USDA NAIP 2010

RealContours™ Regional Jet Departure Tracks (April 2011)

Figure 6-8

Departure Flight Tracks

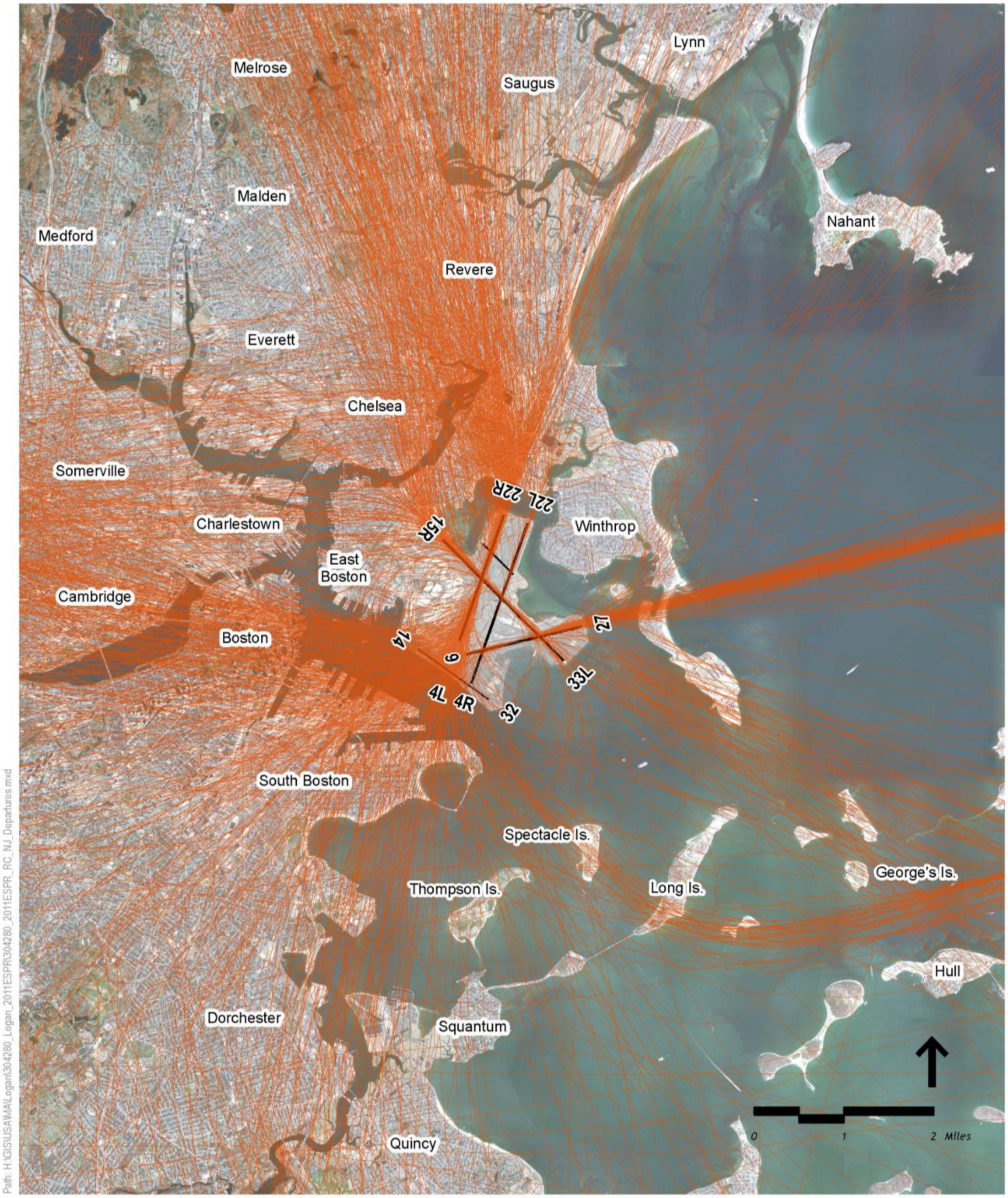


Source: Massport NOMS / ERA Multi-Lat, MassGIS, USDA NAIP 2010

RealContours™ Regional Jet Arrival Tracks (April 2011)

Figure 6-9

Arrival Flight Tracks

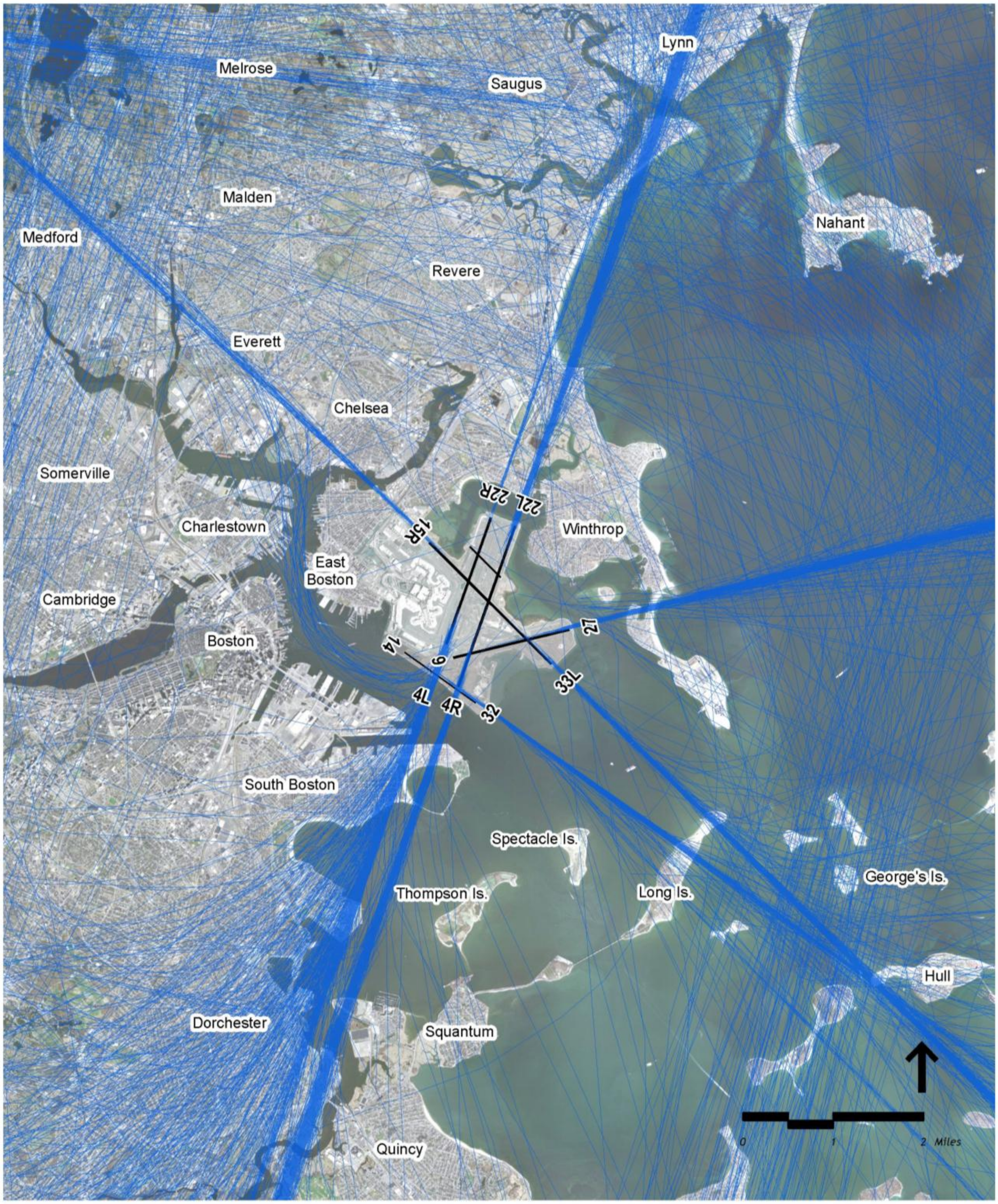


Source: Massport NOMS / ERA Multi-Lat, MassGIS, USDA NAIP 2010

RealContours™ Non-Jet Departure Tracks (April 2011)

Figure 6-10

Departure Flight Tracks



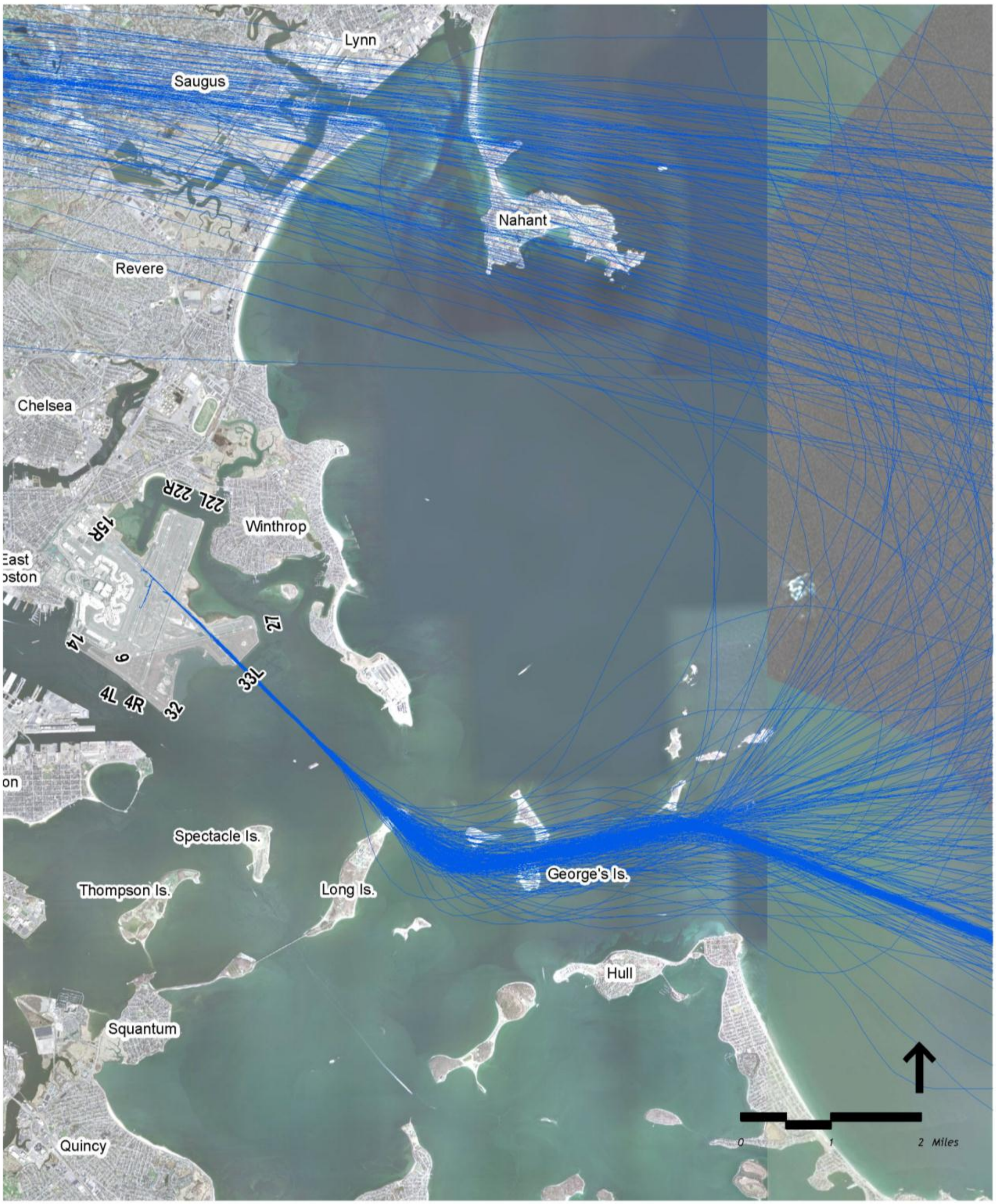
Path: H:\GIS\USA\MA\Logan\304280_Logan_2011ESPR\304280_2011ESPR_RC_NJ_Arrivals.mxd

Source: Massport NOMS / ERA Multi-Lat, MassGIS, USDA NAIP 2010

RealContours™ Non-Jet Arrival Tracks (April 2011)

Figure 6-11

Arrival Flight Tracks



Path: H:\GIS\USAMA\Logan\304280_Logan_2011ESPR\304280_2011ESPR_RWY_33L_Arrivals.mxd

Source: Massport NOMS / ERA Multi-Lat, MassGIS, USDA NAIP 2010

Runway 33L Night (10:00pm – 07:00am) Light Visual Approach Tracks (April 2011)

Figure 6-12

Arrival Flight Tracks

Noise Levels in 2011

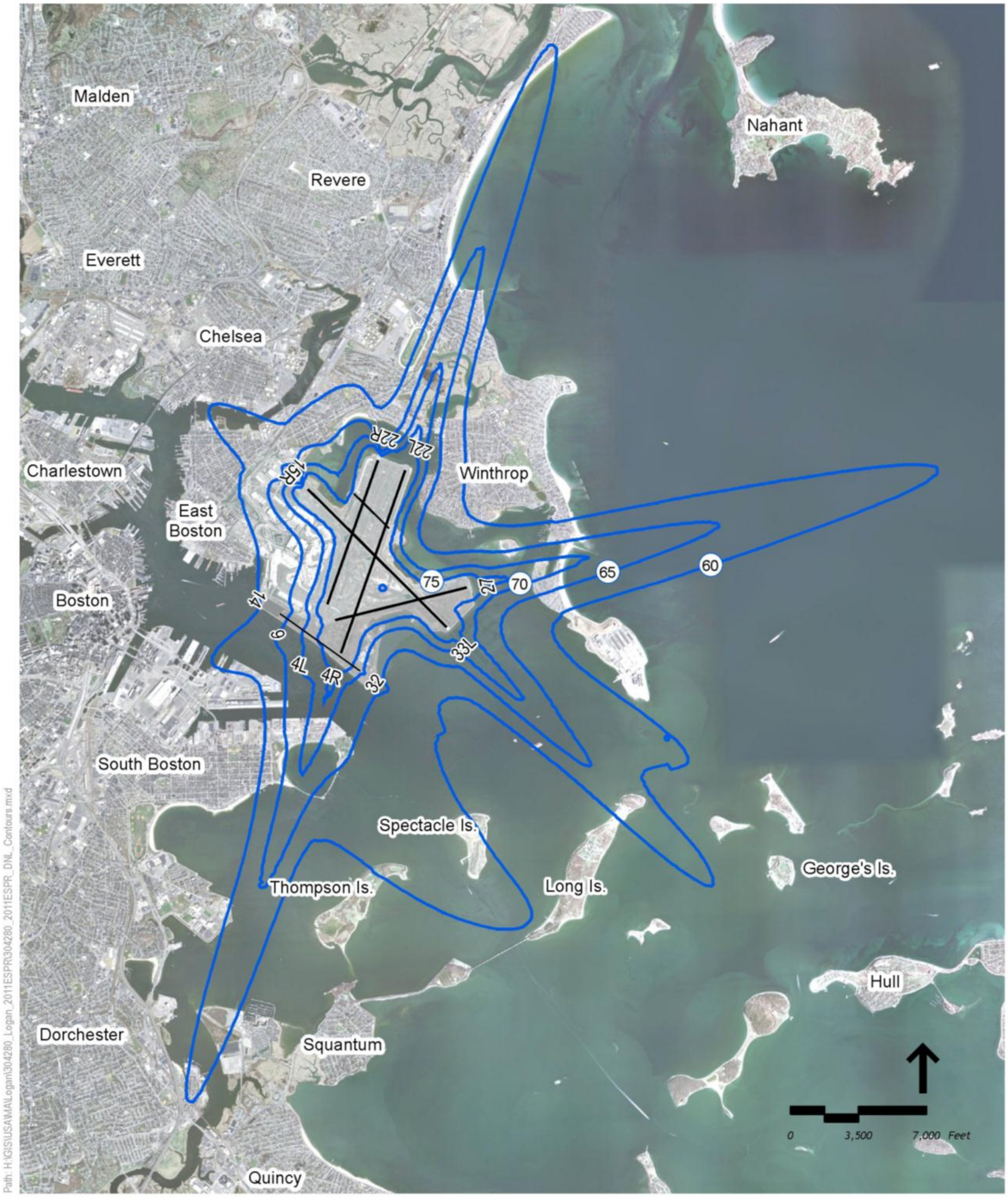
Day-Night Noise Contours for 2011

The 2011 DNL contours were prepared using FAA's most recently available version of the INM (INMv7.0c) and are shown in Figure 6-13 for DNL values of 60, 65, 70, and 75 dB. Figure 6-14 is a closer view of the Airport and compares the DNL 65 dB contours for 2011 and 2010. Differences between these annual contours are a result of two factors: the operational differences (increased operations, changes in fleet mix, and changes in runway use) from one year to the next, and an update to the INM noise model. Both the 2010 and 2011 contours continue to include the FAA-approved adjustments for over-water sound propagation and hill effects in Orient Heights, unique to Logan Airport.

In general, the shapes of the 2011 DNL 60 and 65 dB contours differ from the 2010 contours for two primary reasons. First, the cross-wind runway, Runway 15R-3L, was closed between July 1, 2011 and October 1, 2011 for construction of the Runway 33L RSA improvements. This closure shifted operations to the other runways, resulting in the DNL contour shrinking toward the airport in the northwest and expanding slightly to the northeast and southwest. The second reason for changed contours is the implementation of new FAA navigation procedures for Runway 22 departures at the end of 2010 as a result of the BLANS project. Departures turn east over the water in a more constrained, narrower corridor; hence the expansion of the DNL 60 dB contour over Spectacle Island.

Figure 6-15 provides a comparison between the 2011 DNL contours generated with INM 7.0c and INM 7.0b. Both contours use the same fleet mix and runway use only the model version has changed. The graphic shows the minor changes in the contour due to the model changes. Several new GA jets were added to the model replacing substitutes used in the prior version of the INM model. Also, several aircraft model type substitutions were changed between INM 7.0b and INM 7.0c. The Airbus noise approach data was also modified contributing to the very small increase in the arrival noise areas off each runway. The only area where there is a noticeable difference between the two contours is over water.

The DNL 65 dB contour is within populated areas already sound-insulated by Massport (refer to the Noise Abatement discussion presented later on in this chapter).

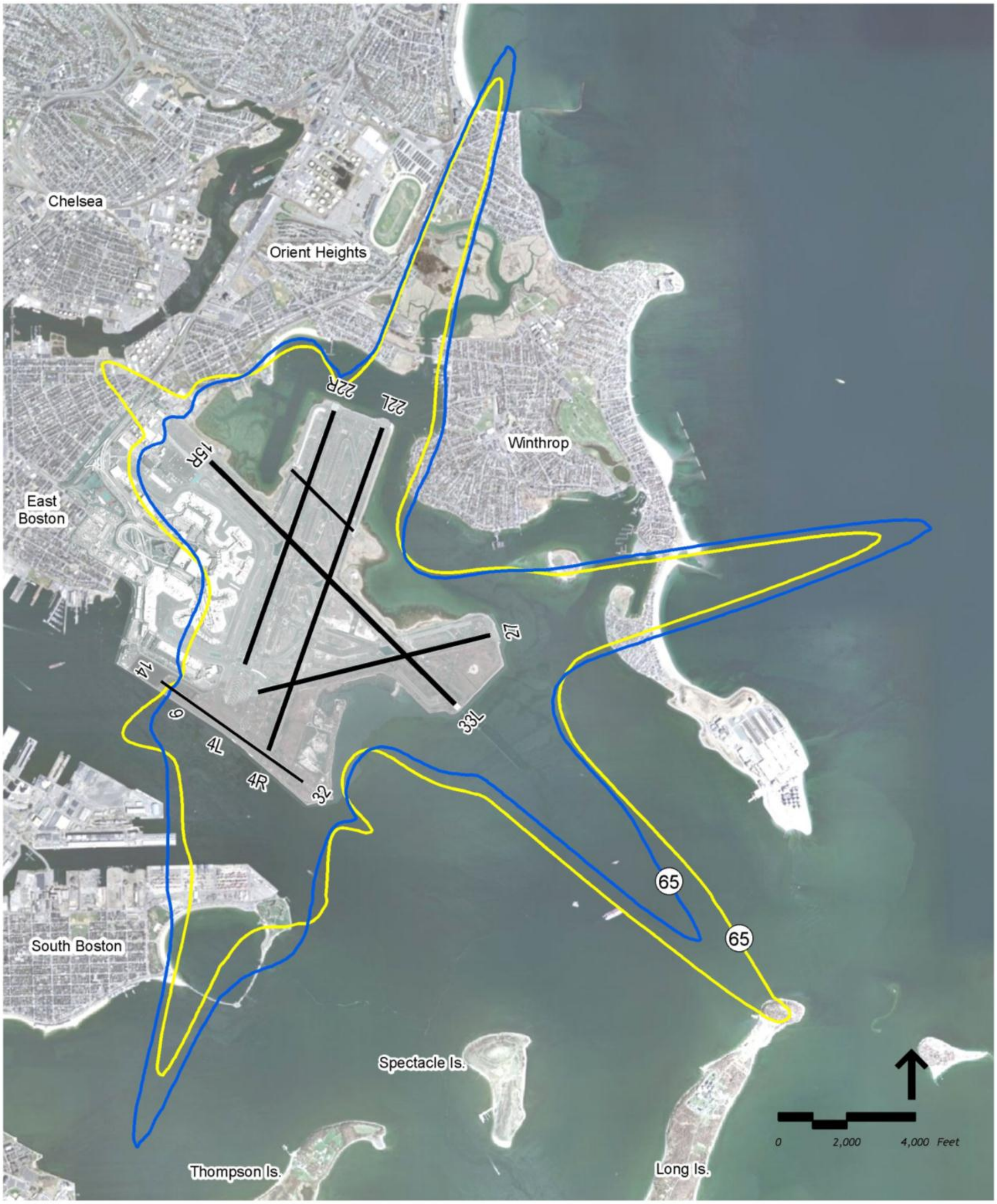


Source: Massport NOMS / ERA Multi-Lat, MassGIS, USDA NAIP 2010

2011 DNL Contour (INM 7.0c)

60-75 DNL Contours for 2011 Operations Using INM 7.0c

Figure 6-13



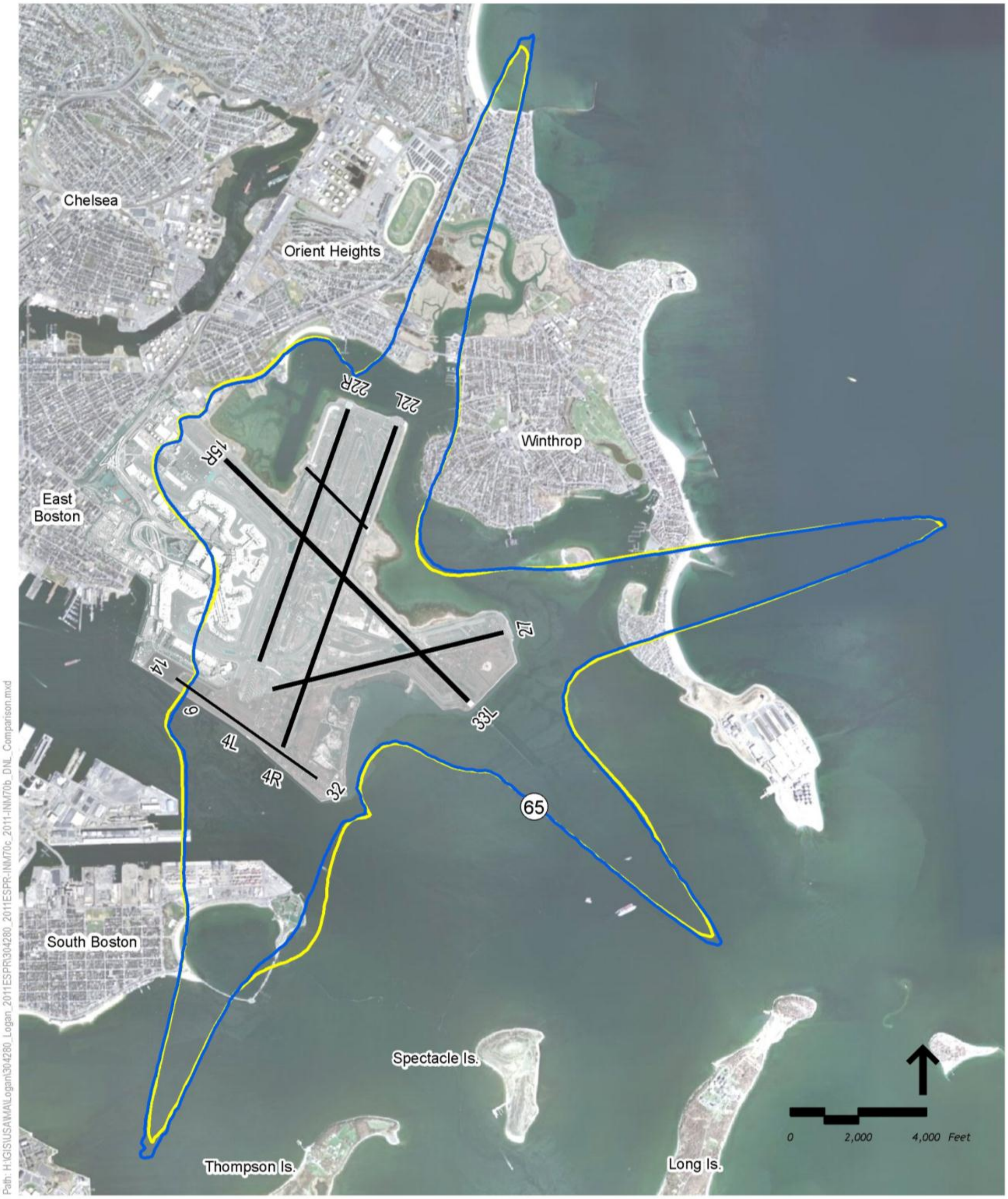
Path: H:\GIS\USAMA\Logan\304280_Logan_2011ESPR\304280_2011ESPR-INM70c_2010-INM70b_DNL_Comparison.mxd

Source: Massport NOMS / ERA Multi-Lat, MassGIS, USDA NAIP 2010

2011 DNL Contour (INM 7.0c)
2010 DNL Contour (INM 7.0b)

Comparison of the 65 dB DNL Contours for 2010 Operations Using INM 7.0b and 2011 Operations Using INM 7.0c

Figure 6-14



Source: Massport NOMS / ERA Multi-Lat, MassGIS, USDA NAIP 2010

2011 DNL Contour (INM 7.0c)

2011 DNL Contour (INM 7.0b)

Comparison of the 65 dB DNL Contours for 2011 Operations Using INM 7.0b and 2011 Operations Using INM 7.0c

Figure 6-15

Population Impact Assessment

Population counts within selected 5 dB increments of exposure are reported each year to indicate how Logan Airport's noise environment changes over time. Population counts for 2011 are shown in Table 6-6 by community and are compared to previous years. The 2010 U.S. Census data, previously reported in the *2010 EDR,* was used to determine population counts. Population counts from 2000 through 2009 are based on U.S. Census data for 2000. *Appendix H, Noise Abatement* presents counts for 2010 from both sets of Census data. The 2010 Census data includes updated population counts and can be used to demonstrate the changes in population in an area over a ten year period.

Both the FAA and the U.S. Department of Housing and Urban Development (HUD) consider DNL exposure levels above 65 dB to be incompatible with residential land use. Table 6-6 compares impacted populations for each year, using the latest INM results. The noise analysis is based upon the most recently FAA-approved INM (INMv7.0c). Table 6-7 provides an additional breakdown of the estimated population in East Boston and South Boston residing within the DNL 65 dB contour.

The differences in affected population between 2010 and 2011 in Tables 6-6 and 6-7 are due to fleet mix and runway use changes. There were no affected population differences within the DNL 65 dB contour between the two 2011 model runs (INM v7.0b and INM v7.0c). The differences in the contour, are attributed mostly to the difference in runway use due to the closure of Runway 15R-33L and shifts in the flight tracks due to the new RNAV procedures. These procedures also concentrate the flight tracks over a smaller area which tends to elongate the contours. The number of people within the DNL 65 dB increased by 117 people overall. In East Boston, there was a decrease of 358 people with a corresponding increase in Revere of 161 people and in Winthrop there was an increase of 341 people. The number of people remaining within the DNL 70 dB contour remains the same as 2010 with 130 people, located in Winthrop.

Table 6-6 Noise-exposed Population by Community[1]

Boston							Revere						
Year	Census	80+ DNL	75-80 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL	Year	Census	80+ DNL	75-80 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL
2000	2000	0	0	234	9,014	9,248	2000	2000	0	0	0	2,496	2,496
2001	2000	0	0	315	6,515	6,700	2001	2000	0	0	0	2,496	2,496
2002	2000	0	0	257	2,625	2,757	2002	2000	0	0	0	2,822	2,822
2003	2000	0	0	164	1,730	1,894	2003	2000	0	0	0	2,994	2,994
2004	2000	0	0	132	5,374	5,5506	2004	2000	0	0	0	2,822	2,822
2005	2000	0	65	104	2,020 [3]	2,189 [3]	2005	2000	0	0	82	2,540	2,622
2006	2000	0	65	99	1,054 [3]	1,218 [3]	2006	2000	0	0	82	2,540	2,622
2007	**2000**	0	0	169	4,094	4,263	2007	**2000**	0	0	0	2,450	2,450
2008 (7.0a)	**2000**	0	0	0	2,376	2,376	**2008 (7.0a)**	**2000**	0	0	0	2,434	2,434
2008 (7.0b)	**2000**	0	5	0	3,487	3,492	**2008 (7.0b)**	**2000**	0	0	0	2,434	2,434
2009 (7.0b)	**2000**	0	5	67	937	1,009	**2009 (7.0b)**	**2000**	0	0	0	2,512	2,512
2010 (7.0b)	**2010**	0	0	0	689	689	**2010 (7.0b)**	**2010**	0	0	0	2,413	2,413
2011 (7.0b)	**2010**	0	0	0	331	331	**2011 (7.0b)**	**2010**	0	0	0	2,547	2,547
2011 (7.0c)	**2010**	0	0	0	331	331	**2011 (7.0c)**	**2010**	0	0	0	2,547	2,547

Table 6-6 Noise-exposed Population by Community[1] (Continued)

Chelsea

Year	Census	80+ DNL	75-80 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL
2000	2000	0	0	0	0	0
2001	2000	0	0	0	0	0
2002	2000	0	0	0	0	0
2003	2000	0	0	0	0	0
2004	2000	0	0	0	0	0
2005	2000	0	0	0	0	0
2006	2000	0	0	0	0	0
2007	**2000**	0	0	0	0	0
2008 (7.0a)	**2000**	0	0	0	0	0
2008 (7.0b)	**2000**	0	0	0	0	0
2009 (7.0b)	**2000**	0	0	0	0	0
2010(7.0b)	**2010**	0	0	0	0	0
2011 (7.0b)	**2010**	0	0	0	0	0
2011 (7.0c)	**2010**	0	0	0	0	0

Winthrop

Year	Census	80+ DNL	75-80 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL
2000	2000	0	247	1,070	4,637	6,001
2001	2000	0	244	683	4,123	5,050
2002	2000	0	2	481	2,247	2,730
2003	2000	0	0	339	1,956	2,295
2002	2000	0	2	412	1,978	2,392
2005	2000	0	39	347	1,280	1,666
2006	2000	0	39	416	1,288	1,743
2007	**2000**	0	0	247	1,139	1,386
2008 (7.0a)	**2000**	0	0	244	909	1,153
2008 (7.0b)	**2000**	0	0	244	1,409	1,653
2009 (7.0b)	**2000**	0	0	171	643	814
2010 (7.0b)	**2010**	0	0	130	598	728
2011 (7.0b)	**2010**	0	0	130	939	1,069
2011 (7.0c)	**2010**	0	0	130	939	1,069

Everett

Year	Census	80+ DNL	75-80 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL
2000	2000	0	0	0	0	0
2001	2000	0	0	0	0	0
2002	2000	0	0	0	0	0
2003	2000	0	0	0	0	0
2004	2000	0	0	0	0	0
2005	2000	0	0	0	0	0
2006	2000	0	0	0	0	0
2007	**2000**	0	0	0	0	0
2008 (7.0a)	**2000**	0	0	0	0	0
2008 (7.0b)	**2000**	0	0	0	0	0
2009 (7.0b)	**2000**	0	0	0	0	0
2010 (7.0b)	**2010**	0	0	0	0	0
2011 (7.0b)	**2010**	0	0	0	0	0
2011 (7.0c)	**2010**	0	0	0	0	0

All Communities

Year	Census	80+ DNL	75-80 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL
2000	2000	0	247	1,304	16,147	17,745
2001	2000	0	244	998	13,004	14,246
2002	2000	0	2	613	7,694	8,309
2003	2000	0	0	503	6,680	7,183
2004	2000	0	2	544	10,174	10,720
2005	2000	0	104	533	5,840 [3]	6,477 [3]
2006	2000	0	104	597	4,882 [3]	5,583 [3]
2007	**2000**	0	0	416	7,683	8,099
2008 (7.0a)	**2000**	0	5	244	5,719	5,968
2008 (7.0b)	**2000**	0	5	244	7,330	7,579
2009 (7.0b)	**2000**	0	5	238	4,092	4,335
2010 (7.0b)	**2010**	0	0	130	3,700	3,830
2011 (7.0b)	**2010**	0	0	130	3,817	3,947
2011 (7.0c)	**2010**	0	0	130	3,817	3,947

Source: HMMH 2011, Massport.

Notes: Population counts for 2000 through 2009 are based on the 2000 U.S. Census block data and the contours beginning in 2004 from the RealContours™ system
Population counts for 2010 and 2011 are provided for the 2010 U.S. Census block data (as indicated) and the contours are from the RealContours™ system

1 Data for years prior to 2000 is available in *Appendix H, Noise Abatement*. 7.0a, 7.0b, and 7.0c refer to INMv7.0a, INMv7.0b, and INMv7.0c respectively.

2 65 dB DNL is the federally-defined noise criterion used as a guideline to identify when residential land use is considered incompatible with aircraft noise.

3 These values reflect the effect of the FAA-approved terrain adjustment in Orient Heights.

Table 6-7 Estimated Population within 65 dB[1] DNL Contour[2]

Year	Census Base	Boston: East Boston	Boston: South Boston	Boston: Total	Chelsea	Revere	Winthrop	Everett	All Communities
2000	**2000**	8,979	269	9,248	0	2,496	6,001	0	**17,745**
2001	**2000**	6,639	61	6,700	0	2,496	5,050	0	**14,246**
2002	**2000**	2,757	0	2,757	0	2,822	2,730	0	**8,309**
2003	**2000**	1,894	0	1,894	0	2,994	2,295	0	**7,183**
2004	**2000**	4,399	0	4,399	0	3,051	1,988	0	**9,438**
2005	**2000**	2,155	34	**2,189**[3]	0	2,622	1,666	0	**6,477**
2006 (INMv6.2a)	**2000**	1,184	34	**1,218**[3]	0	2,622	1,743	0	**5,583**
2007 (INMv7.0a)	**2000**	4,263	0	**4,263**	0	2,450	1,386	0	**8,099**
2008 (INMv7.0b)	**2000**	3,492	0	**3,492**	0	2,434	1,653	0	**7,579**
2009 (INMv7.0b)	**2000**	1,009	0	**1,009**	0	2,512	814	0	**4,335**
2010 (INMv7.0b)	**2010**	689	0	**689**	0	2,413	728	0	**3,830**
2011 (INMv7.0b)	**2010**	331	0	**331**	0	2,574	1,069	0	**3,947**
Change 2010 to 2011		(358)	0	**(358)**	0	161	341	0	**117**
2011 (INMv7.0c)	**2010**	331	0	**331**	0	2,574	1,069	0	**3,947**
Change INM 7.0b to INM 7.0c for 2011		0	0	**0**	0	0	0	0	**0**

Source: HMMH 2011, Massport.
Notes: Population counts for 2005 through 2009 are based on the 2000 U.S. Census block data and the contours are from the RealContours™ system
Population counts for 2010 and 2011 are provided for the 2010 U.S. Census block data (as indicated) and the contours are from the RealContours™ system
Within the DNL 65 dB contour there was no difference in the number of people between the two 2011 INM model runs.
1 65 dB DNL is the federally-defined noise criterion used as a guideline to identify where residential land use is considered incompatible with aircraft noise.
2 Data for years prior to 2000 is available in *Appendix H, Noise Abatement.*
3 These values reflect the effect of the FAA-approved terrain adjustment in Orient Heights.

The increase in operations and the closure of Runway 15R-33L between 2010 and 2011 led to a small 3.1 percent increase in the total number of people living within the DNL 65 dB contour from 3,830 to 3,947. Due to the shift in runway use, East Boston had a decrease with 358 fewer people exposed to noise levels DNL 65 dB or greater compared to 2010. For historical context, noise impacts were greater in 2000 when 8,979 people exposed to levels DNL 65 dB in East Boston and 269 people in South Boston.

The higher use of Runways 4R for departures and 22L for arrivals in 2011 resulted in 161 more people exposed to DNL 65 dB in Revere. The total number exposed in Revere in 2011 (2,754) is slightly higher than the 2,496 exposed in the year 2000. There was also an increase of 341 people in Winthrop exposed to DNL 65 dB and above due to increased use of Runway 9 for departures. Winthrop, similar to Boston, has experienced a dramatic reduction in exposed population dropping from 6,001 in 2000 to 1,069 in 2011. The higher number of people exposed in Revere and Winthrop in 2011 offset the reductions in people exposed in East Boston resulting in the small increase in population.

The total population exposed to noise levels between DNL 70 to 75 dB remained the same as 2010. Compared to 2000, there has been a significant reduction in the people exposed to the higher noise levels also. The

number in Boston has dropped from 234 people exposed in 2000 to zero in 2011. Revere has remained at zero compared to 2000 with Winthrop having reductions from 1,317 people exposed in 2000 to 130 in 2011.

Comparing Measured and Modeled Noise Levels

When changes in noise exposure are predicted by the INM, it is important to substantiate these modeled findings with actual noise measurements, such as those taken with Massport's permanent noise monitoring system. Massport's system continuously measures the noise levels at each of 30 microphone locations around the Airport and environs, as shown in Figure 6-16. During normal operation, noise monitors at the microphone locations measure noise exposure levels as well as a variety of metrics associated with individual noise events that exceed preset threshold sound levels. Noise monitoring data are transmitted back to Massport's Noise Office, where daily DNL values and other noise metrics are computed for each location and summarized in various reports.

This *2011 ESPR* compares the measured annual average DNL values from the monitors to INM-computed values of DNL at each of the specific noise monitor sites to check for reasonableness. Many sites produced small differences between measurements and predictions, particularly as adjustments were incorporated into the modeling process to account for the over-water sound propagation and hill effects. However, results at more distant locations have often produced substantial differences of 10 dB or more, especially at measurement sites where DNL values were often less than 60 dB. In 2011, with the Airport's noise measurement equipment and monitoring system and its ability to correlate measured noise events with individual flight tracks, combined with the improvements in the INM database, differences between measured and modeled values have narrowed from the values even more than reported in previous EDRs and ESPRs.[23]

Aircraft altitude is a second factor that contributes to the differences between measured and modeled DNL values (especially at the more-distant noise monitoring sites). Typical noise modeling uses distance from origin to destination to determine the appropriate climb profile for an aircraft; however, many aircraft climb more slowly than the standard profiles would suggest, especially if the pilot must make a turn shortly after takeoff. By modeling the actual climb profile instead of selecting the best fit among a standard set, better measured versus modeled results should be expected. This technique resulted in modeling lower altitudes over many of the farther out monitoring sites, is a better reflection of reality, and further reduced the differences between measured and modeled sound levels at those locations.

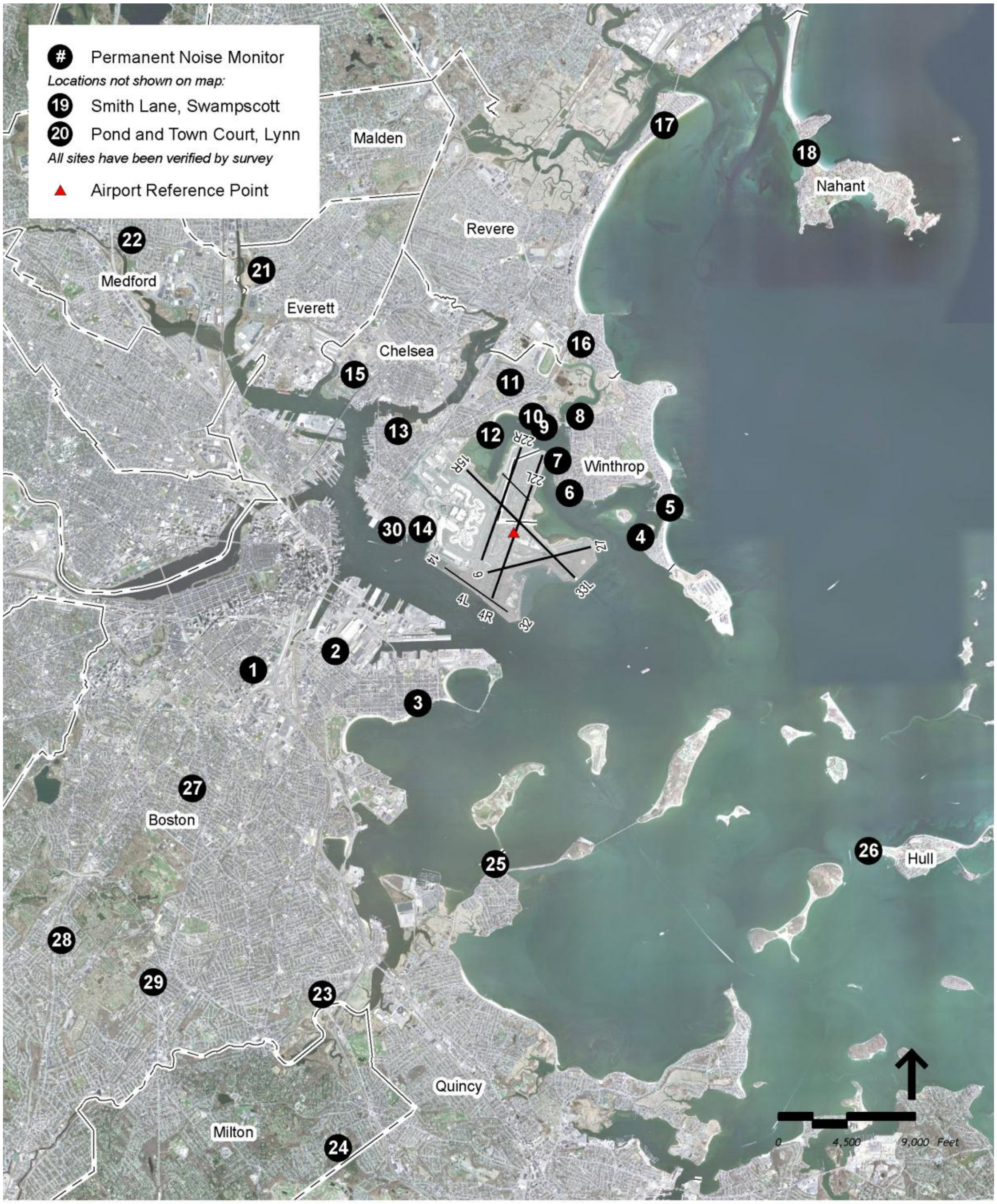
Finally, latitudes and longitudes of each measurement site were verified by survey and their exact coordinates entered into the INM. These improvements in modeling techniques are now fully integrated into the measured-versus-modeled INM comparisons that follow.

Table 6-8 compares the measured 2010 DNL values to the measured 2011 DNL values at each location. Measured sound levels generally dropped between 2010 and 2011. Eleven locations had decreases of more than 2 dB while two had an increase of more than 2 dB; the remaining 17 locations had changes in levels of less than 2 dB. The average measured value for 27 of the sites was 55.0 dB in 2010 and dropped 1.0dB to 54.0 dB in 2011 (Sites 3, 12 and 15 are excluded from the averages due to issues at each site). During 2010, Site 3 had issues due to noise interference from an outside source, which was not an issue in 2011. Site 12 was decommissioned in 2010 and will be relocated. Site 15 had power issues for over six months of 2011. To keep the sites used for the averages consistent, Site 3, 12 and 15 were excluded from the computations. The elimination of these sites from the averages has most likely lowered the average value for each year since these

23 Several factors have resulted in better agreement between measured versus modeled levels. Beginning with the 2009 EDR, flight track data and measurement data have come from the new monitoring system. The more accurate flight track data is used for the modeling inputs and for the measured aircraft event correlation.

sites had measured values greater than DNL 60 dB due to their proximity to the Airport. The average of the absolute difference between the measured values at each site between 2010 and 2011 is 2.1 dB.

Figure 6-16 Noise Monitor Locations



Source: Massport NOMS / ERA Multi-Lat, MassGIS, USDA NAIP 2010

Table 6-8 Measured Versus Measured - Comparison of Measured DNL Values From 2010 to 2011

Location	Site	Distance from Logan Airport (miles)	2010 Measured Aircraft (DNL)	2011 Measured Aircraft (DNL)	Difference 2011 minus 2010
South End – Andrews Street	1	3.7	54.6	51.7	(2.9)
South Boston – B and Bolton	2	2.9	57.7	52.9	(4.8)
South Boston – Day Blvd. near Farragut	3	2.5	64.1	62.3	(1.8)
Winthrop – Bayview and Grandview	4	1.6	70.2	71.6	1.4
Winthrop – Harborview and Faun Bar	5	1.9	62.6	64.0	1.4
Winthrop – Somerset near Johnson	6	0.8	62.4	61.3	(1.1)
Winthrop – Loring Road near Court	7	1.0	65.1	65.5	0.4
Winthrop – Morton and Amelia	8	1.6	59.1	59.8	0.7
East Boston – Bayswater near Annavoy	9	1.3	66.2	66.6	0.4
East Boston – Bayswater near Shawsheen	10	1.3	62.3	62.2	(0.1)
East Boston – Selma and Orient	11	1.8	55.7	55.7	0
East Boston Yacht Club	12	1.2			
East Boston High School	13	1.9	62.2	58.5	(3.7)
East Boston – Jeffries Point Yacht Club	14	1.2	56.2	53.5	(2.7)
Chelsea – Admiral's Hill	15	2.8	61.2	57.1	(4.1)
Revere – Bradstreet and Sales	16	2.4	67.5	68.5	1
Revere – Carey Circle	17	5.3	58.6	59.6	1
Nahant – U.S.C.G. Recreational Facility	18	5.9	43.0	42.4	(0.6)
Swampscott – Smith Lane	19	8.7	42.0	40.5	(1.5)
Lynn – Pond and Towns Court	20	8.4	51.9	54.0	2.1
Everett – Tremont near Prescott	21	4.5	50.6	44.4	(6.2)
Medford – Magoun near Thatcher	22	6.0	50.6	46.6	(4)
Dorchester – Myrtlebank near Hilltop	23	6.3	50.9	52.6	1.7
Milton – Cunningham Park near Fullers	24	8.1	47.9	49.4	1.5
Quincy – Squaw Rock Park	25	4.2	40.4	43.5	3.1
Hull – Hull High School near Channel Street	26	6.0	57.4	56.1	(1.3)
Roxbury – Boston Latin Academy	27	5.3	54.2	50.1	(4.1)
Jamaica Plain – Southbourne Road	28	7.7	45.5	41.4	(4.1)
Mattapan – Lewenburg School	29	7.3	40.5	37.8	(2.7)
East Boston – Piers Park	30	1.5	49.8	47.0	(2.8)
Absolute Average [1]			55.0	54.0	2.1

Source: HMMH
Notes: Changes in ( ) represent a decrease in measured noise level from 2010 to 2011.
Distance from Logan Airport calculated from the Airport Reference Point.
Site 12 was not operational for most of 2010 and 2011. It was operational in 2009.
Site 3 had interference from an outside source in 2010.
Site 15 had a power source issue (out 1/27/11 – 8/3/11).
1 Sites 3, 12 and 15 are not included in the Average values.

Table 6-9 compares the measured 2011 DNL values at each measurement site to the modeled 2011 DNL values. The average measured value for twenty-seven of the sites is 54.0 dB in 2011 and the average modeled value is 57.1 dB in 2011 (Site 3, 12 and 15 are excluded from the averages due to issues at each site). The closure of Runway 15R-33L (Runway 15R departures head out over Boston Harbor) increased use of other runways increasing the average value at the measurement sites. The average of the absolute difference between the measured versus modeled values for 2010 is 1.9 dB and 1.8 dB in 2011.

Using RealContours™, Massport is able to compute the modeled DNL for exactly the same periods for which the noise monitoring system was collecting data at each site. As shown in Table 6-9, 13 of the sites have 2011 modeled levels more than 2 dB different from measured levels, and at 22 sites the modeled levels are higher than the measured levels. At sixteen of these locations where modeled exceeds measured, the measured levels are below DNL 60 dB, and at seven sites the measured levels are below DNL 50 dB. It is not unusual to experience differences between measured and modeled levels at the locations with lower measured DNL values. The monitor identification of aircraft noise events becomes more difficult, and long distance effects can reduce levels that the model cannot duplicate. At Sites 7, 8 and 9 the difference between measured and modeled is greater than in 2010. Site 6 in Winthrop, where the modeled level is 0.5 dB greater than measured levels, experiences side-line noise from start of takeoff, and levels are subject to over-water propagation, which are adjusted using the approved method for Logan Airport.

In 2000, the prior monitoring system did separate out aircraft only measured values and the absolute average difference between measured and modeled was 2.8 dB versus 1.8 dB in 2011. Measured noise levels in general have decreased with the average measured noise level in 2000 equal to DNL 62.5 dB and in 2011 equal to DNL 54.0 dB which is a drop of 8.5 dB over the past 11 years. All of the sites have lower values than 2000 except for Site 20 in Lynn which measured approximately the same 53.6 dB in 2000 and 54.0 in 2011. The measured level is almost equal even though arrivals to Runway 22L have increased from 7 percent in 2000 to 16 percent in 2011. This site also measured a 2.1 dB increase compared to 2010 which is most likely due to the increased use of 22L due to the Runway 15R-33R runway closure. Sites such as the three monitors in South Boston had measured values ranging from 62.6 dB to 66.3 dB in 2000 and measured 51.7 dB to 62.3 dB in 2011.

Table 6-9 Measured Versus Modeled - Comparison of Measured DNL Values to RealContours™-modeled DNL Values, 2011

Location	Site	Distance from Logan Airport (miles)	2011 Measured Aircraft – Only DNL	2011 Modeled RC Results INMv7.0c(DNL)[1]	2010 Difference Modeled minus Measured	2011 Difference Modeled minus Measured
South End – Andrews Street	1	3.7	51.7	51.1	(1.7)	(0.6)
South Boston – B and Bolton	2	2.9	52.9	55.4	0.1	2.5
South Boston – Day Blvd. near Farragut	3	2.5	62.3	61.2	(4.7)	(1.1)
Winthrop – Bayview and Grandview	4	1.6	71.6	73.1	1.9	1.5
Winthrop – Harborview and Faun Bar	5	1.9	64.0	64.3	0.1	0.3
Winthrop – Somerset near Johnson	6	0.8	61.3	61.8	(1.1)	0.5
Winthrop – Loring Road near Court	7	1.0	65.5	69.2	1.8	3.7
Winthrop – Morton and Amelia	8	1.6	59.8	62.0	1.6	2.2
East Boston – Bayswater near Annavoy	9	1.3	66.6	70.6	3.8	4.0
East Boston – Bayswater near Shawsheen	10	1.3	62.2	62.7	(0.4)	0.5
East Boston – Selma and Orient[2]	11[2]	1.8	55.7	54.5	1.6	(1.2)
East Boston Yacht Club	12	1.2		67.2		
East Boston High School	13	1.9	58.5	59.4	(0.4)	0.9
East Boston – Jeffries Point Yacht Club	14	1.2	53.5	55.1	(0.8)	1.6
Chelsea – Admiral's Hill	15	2.8	57.1	57.4	(1.3)	0.3
Revere – Bradstreet and Sales	16	2.4	68.5	68.4	0.2	(0.1)
Revere – Carey Circle	17	5.3	59.6	59.3	0.0	(0.3)
Nahant – U.S.C.G. Recreational Facility	18	5.9	42.4	45.0	1.4	2.6
Swampscott – Smith Lane	19	8.7	40.5	45.6	3.6	5.1
Lynn – Pond and Towns Court	20	8.4	54.0	52.5	(0.1)	(1.5)
Everett – Tremont near Prescott	21	4.5	44.4	49.1	1.5	4.7
Medford – Magoun near Thatcher	22	6.0	46.6	49.0	0.3	2.4
Dorchester – Myrtlebank near Hilltop	23	6.3	52.6	54.1	2.0	1.5
Milton – Cunningham Park near Fullers	24	8.1	49.4	54.0	5.0	4.6
Quincy – Squaw Rock Park	25	4.2	43.5	47.7	5.8	4.2
Hull – Hull High School near Channel Street	26	6.0	56.1	55.7	(1.9)	(0.4)
Roxbury – Boston Latin Academy	27	5.3	50.1	50.2	(1.7)	0.1
Jamaica Plain – Southbourne Road	28	7.7	41.4	46.5	3.2	5.1
Mattapan – Lewenburg School	29	7.3	37.8	44.9	5.8	7.1
East Boston – Piers Park	30	1.5	47.0	52.4	3.5	5.4
Absolute Average [3]			54.0	57.1	1.9	1.8

Source: HMMH

Note: 2010 and 2011 Modeled results were computed for the whole year.
Distance from Logan Airport calculated from the Airport Reference Point.

I NMv7.0c with adjusted database. (Database modifications as described in the *Logan Airport 1994/1995 Generic Environmental Impact Report).*

2 Includes FAA-approved terrain adjustment modifying normal INMv7.0c result for Site 11.

3 Sites 3, 12, and 15 are not included in the average values.

NA Not available.

Supplemental Metrics

To better describe the noise environment, this *2011 ESPR* includes supplemental noise metrics: CNI, dwell and persistence, and times above a noise threshold.

Cumulative Noise Index (CNI)

Massport reports total annual fleet noise at Logan Airport, defined in the Logan Airport Noise Rules by a metric referred to as the CNI. The CNI is a single number representing the sum of the entire set of single-event effective perceived noise levels (EPNL) experienced at Logan Airport over a full year of operation, weighted similarly to DNL so that activity occurring at night is penalized by adding an extra 10 dB to each event. This penalty is equivalent to multiplying the number of nighttime events of each aircraft by a factor of 10.

The Logan Airport Noise Rules define CNI in units of EPNdB and require that the index be computed for the fleet of commercial aircraft operating at Logan Airport throughout the year. In addition, in EDRs and ESPRs, Massport reports partial CNI values of noise at Logan Airport, so that various subsets of the fleet (cargo, night operations, passenger jets, etc.) are identified. Utilizing the expanded data available from the NOMS, all of the available aircraft registration data were used to select the proper noise certification levels from the latest aircraft noise registration database.[24]

The Noise Rules, adopted by Massport following public hearings held in February 1986, established a CNI limit of 156.5 EPNdB. The CNI generally has decreased since 1990, remaining below that cap, and typical changes from one year to the next have been within a few tenths of a dB. The 2011 CNI of 152.1 EPNdB represents a 0.2 dB increase from 2010 but remained well below the cap of 156.5 EPNdB. The partial CNI decreased in 10 categories and increased in 11 categories compared to 2010. The last time the CNI increased was in 2008 which was also a 0.2 dB increase. 2008 had a similar level of operations as 2011 but the total CNI in 2011 is 0.8 dB less than in 2008. This reflects the continued use of quieter aircraft at the Airport.

Partial CNI Calculations

Partial CNI values were obtained by summing the noise from particular segments of Logan Airport's total operations. They are useful for identifying the greatest contributors to overall noise. As shown in Table 6-10, the sectors of the fleet with the highest numbers of partial CNI indicate a greater contribution to total noise. Table 6-10 also indicates that:

- Passenger jets contributed approximately 3.9 dB more noise to the total exposure in 2011 than cargo aircraft.
- Daytime passenger decreased 0.1dB with nighttime passenger decreasing by 0.5 dB compared to 2010.
- Nighttime operations continued to contribute more noise than daytime activity, and nighttime flights by air carriers contributed more noise than nighttime cargo operations.
- Daytime cargo increased 2.1 dB with nighttime cargo increasing by 1.6 dB compared to 2010.
- One Lear 25 (Stage 2 aircraft less than 75,000 pounds) operation occurred during 2011 by a cargo operator. The operator typically operates a Lear 35 (Stage 3 aircraft less than 75,000 pounds).

24 Type-certificate data sheet for noise (TCDSN) database available from the European Aviation Safety Agency; //easa.europa.eu/certification/type-certificates/noise.php.

Table 6-10 Cumulative Noise Index (EPNdB)[1]

	Logan Airport CNI Cap – 156.5 EPNdB					
	2000	**2001**	**2002**	**2003**	**2004**	**2005**
Full CNI (Entire Commercial Jet Fleet)	**154.7**	**154.1**	**153.2**	**152.7**	**153.4**	**153.2**
Total Passenger Jets	153.6	152.9	151.8	151.3	152.2	152.1
Total Cargo Jets	148.2	147.8	147.4	147.1	147.0	146.6
Total Daytime	149.5	149.0	148.5	148.0	148.5	148.2
Total Nighttime	153.1	152.4	151.3	150.9	151.7	151.6
Total Stage 2 Jets	124.7	121.5	114.3	114.1	118.1	NA
Total Stage 3 Jets	154.7	154.1	153.2	152.7	153.4	153.2
Daytime Stage 2	122.6	119.3	111.2	113.7	109.4	NA
Nighttime Stage 2	120.5	117.3	111.4	103.2	117.5	NA
Daytime Stage 3	149.5	149.0	148.5	148.0	148.5	148.2
Nighttime Stage 3	153.1	152.4	151.3	150.9	151.7	151.6
Passenger Jet Stage 2	124.2	116.3	NA	NA	NA	NA
Passenger Jet Stage 3	153.6	152.9	151.8	151.3	152.2	152.1
Cargo Jet Stage 2	114.8	119.9	114.3	114.1	118.1	NA
Cargo Jet Stage 3	148.2	147.8	147.4	147.1	147.0	146.6
Daytime Passenger	149.3	148.7	148.2	147.7	148.2	147.9
Nighttime Passenger	151.6	150.8	149.4	148.8	150.0	150.1
Daytime Cargo	137.5	137.1	137.0	136.2	135.7	135.8
Nighttime Cargo	147.8	147.4	147.0	146.8	146.7	146.2
Daytime Passenger Stage 2	122.3	115.0	NA	NA	NA	NA
Daytime Passenger Stage 3	149.2	148.7	148.2	147.7	148.2	147.9
Nighttime Passenger Stage 2	119.8	110.2	NA	NA	NA	NA
Nighttime Passenger Stage 3	151.6	150.8	149.4	148.8	150.0	150.1
Daytime Cargo Stage 2	111.1	117.3	111.2	113.7	109.4	NA
Daytime Cargo Stage 3	137.5	137.0	137.0	136.1	135.7	135.8
Nighttime Cargo Stage 2	112.3	116.4	111.4	103.2	117.5	NA
Nighttime Cargo Stage 3	147.8	147.4	147.0	146.8	146.7	146.2

Source: HMMH

Table 6-10 Cumulative Noise Index (EPNdB)[1] (Continued)

	Logan Airport CNI Cap – 156.5 EPNdB						
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**Change (2010-2011)**
Full CNI (Entire Commercial	**152.6**	**152.7**	**152.9**	**152.3**	**151.9**	**152.1**	**0.2**
Total Passenger Jets	151.4	151.5	151.9	151.1	150.9	150.6	(0.3)
Total Cargo Jets	146.5	146.4	146.1	145.9	145.1	146.7	1.6
Total Daytime	147.5	147.2	147.6	147.1	146.8	146.9	0.1
Total Nighttime	151.0	151.2	151.4	150.7	150.3	150.6	0.3
Total Stage 2 Jets	NA	NA	NA	NA	113.6[2]	110.8[2]	(2.8)
Total Stage 3 Jets	152.6	152.7	152.9	152.3	151.9	152.1	0.2
Daytime Stage 2	NA	NA	NA	NA	103.6[2]	NA	NA
Nighttime Stage 2	NA	NA	NA	NA	113.1[2]	110.8	(2.3)
Daytime Stage 3	147.5	147.2	147.6	147.1	146.8	146.9	0.1
Nighttime Stage 3	151.0	151.2	151.4	150.7	150.3	150.6	0.3
Passenger Jet Stage 2	NA	NA	NA	NA	NA	NA	NA
Passenger Jet Stage 3	151.4	151.5	151.9	151.1	150.9	150.6	(0.3)
Cargo Jet Stage 2	NA	NA	NA	NA	113.6[2]	110.8[2]	(2.8)
Cargo Jet Stage 3	146.5	146.4	146.1	145.9	145.1	146.7	1.6
Daytime Passenger	147.2	146.9	147.3	146.8	146.6	146.5	(0.1)
Nighttime Passenger	149.3	149.7	150.0	149.1	149.0	148.5	(0.5)
Daytime Cargo	135.5	135.8	135.8	135.2	134.5	136.6	2.1
Nighttime Cargo	146.1	146.0	145.6	145.5	144.7	146.3	1.6
Daytime Passenger Stage 2	NA	NA	NA	NA	NA	NA	NA
Daytime Passenger Stage 3	147.2	146.9	147.3	146.8	146.6	146.5	(0.1)
Nighttime Passenger Stage 2	NA	NA	NA	NA	NA	NA	NA
Nighttime Passenger Stage 3	149.3	149.7	150.0	149.1	149.0	148.5	(0.5)
Daytime Cargo Stage 2	NA	NA	NA	NA	103.6[2]	NA	NA
Daytime Cargo Stage 3	135.5	135.8	135.8	135.2	134.4	136.6	2.2
Nighttime Cargo Stage 2	NA	NA	NA	NA	113.1[2]	110.8[2]	(2.3)
Nighttime Cargo Stage 3	146.1	146.0	145.6	145.5	144.7	146.3	1.6

Source: HMMH 2011
Note: General aviation and non-jet aircraft are not included in the calculation.
NA No operations by this aircraft type in the commercial fleet.
1 Data for years prior to 2000 is available in *Appendix H, Noise Abatement*.
2 The Stage 2 results are from a Lear 25 aircraft arrival and departure flown by a Cargo Operator during 2011. The operator typically operates a Lear 35 aircraft at Logan Airport.

Table 6-11 provides the number of flight operations, the resulting CNI by airline for 2011 and the partial CNI by operation for 2010 and 2011. The table shows the relative contribution of each airline to total CNI and reflects the contributions of individual aircraft noise levels and the frequency with which they occur. The table is sorted by the Partial CNI by operation for 2011 and shows that the major cargo operators all are at the top of this list since they operate primarily at night. JetBlue Airways, with the largest number of operations, has the second highest CNI per airline at 145.0, but its partial CNI by operation is well below the other major airlines in part due to its use of newer aircraft. FedEx has less than one tenth of the operations that JetBlue Airways has but its total CNI per airline is 146.5, or only 1.5 above JetBlue Airways. The partial CNI by operation for FedEx is the highest of all of the airlines and this is due to the Boeing 727 and DC10 which are the primary aircraft in their fleet and the fact that half of their operations are at night.

Regional carriers generally contribute the least to the partial CNI per operation whereas the international carriers, which operate larger aircraft and generally have more operations at night, are just below the cargo operators in rank. The relative positions for the domestic carriers are due mainly to their fleet characteristics and number of night operations. United Air Lines has fewer operations than Southwest Airlines or JetBlue Airways, however, 19.3 percent of its operations at night as compared to Southwest, which had only 13.2 percent at night. JetBlue Airways also has a lower night percentages (13.6 percent) and operates a newer fleet than either American Airlines or United Air Lines.

Table 6-11 Annual Operations and Partial CNI by Airline and per Operation, 2011

Airlines with more than 100 flights in 2011	2011 Operations[1]	2011 Total Airline CNI (EPNdB)	Partial CNI (EPNdB) per Operation 2010	Partial CNI (EPNdB) per Operation 2011	Airline Category
FedEx	5,050	146.5	108.9	109.5	Cargo
United Parcel Service	1,413	137.8	106.5	106.3	Cargo
DHL Airways	492	132.6	105.6	105.7	Cargo
British Airways	2,409	137.1	101.0	103.3	International
Air France	1,013	133.3	103.0	103.3	International
Capital Cargo International	225	126.8	103.1	103.2	Cargo
TACV-Cabo Verde	236	126.0	103.5	102.3	International
Miami Air	179	123.1	101.3	100.6	International
SATA International Airlines	400	126.5	100.4	100.5	International
Lufthansa	1,734	132.9	100.0	100.5	International
Swiss Air	723	127.9	99.3	99.3	International
United Air Lines	15,305	140.7	98.7	98.9	Domestic
Virgin Atlantic	721	127.0	99.5	98.4	International
Virgin America	6,052	135.6	96.6	97.8	Domestic
Continental	9,821	137.7	96.7	97.7	Domestic
American Airlines	21,021	141.0	97.6	97.7	Domestic
Alaska Airlines	1,757	130.0	97.6	97.6	Domestic

Source: HMMH

Table 6-11 Annual Operations and Partial CNI by Airline and per Operation, 2011 (Continued)

Airlines with more than 100 flights in 2011	2011 Operations[1]	2011 Total Airline CNI (EPNdB)	Partial CNI (EPNdB) per Operation 2010	Partial CNI (EPNdB) per Operation 2011	Airline Category
Southwest Airlines	17,387	139.9	96.8	97.5	Domestic
Spirit Airlines	3,054	132.3	96.5	97.4	Domestic
Alitalia	604	124.9	97.1	97.1	International
Frontier Airlines	1,129	127.6	94.9	97.1	Domestic
Aer Lingus	1,126	127.6	97.1	97.1	International
Iberia Air Lines Of Spain	445	123.5	96.9	97.0	International
JetBlue Airways	63,828	145.0	97.2	96.9	Domestic
Delta Air Lines[2]	28,952	141.4	97.3	96.8	Domestic
Astraeus Airlines	100	116.0	NA	96.0	International
US Airways	40,352	141.8	95.2	95.8	Domestic
Allegiant Air	131	116.5	NA	95.4	Domestic
Air Canada	4,163	131.5	96.0	95.3	International
Mesa Airlines	260	119.4	NA	95.3	Regional
Sun Country Airlines	513	122.2	94.6	95.1	Regional
Shuttle America Corp	3,948	130.8	94.2	94.8	Regional
AirTran Airways	12,851	135.8	94.7	94.7	Domestic
Mesaba Airlines	3,117	129.5	93.9	94.6	Regional
Compass Airlines	1,565	125.8	97.3	93.9	Regional
Icelandair	928	123.1	93.9	93.4	International
US Airways Express/Republic	4,365	129.6	95.4	93.2	Regional
Delta Connection/Comair	7,708	131.8	NA	93.0	Regional
Continental Express/Expressjet	2,254	125.2	NA	91.6	Regional
Delta Connection/Atlantic SE	5,088	128.6	90.9	91.6	Domestic
AWAC - US Air Express	6,491	129.5	91.5	91.4	Regional
American Eagle Airlines	8,816	130.2	91.5	90.8	Regional
Horizon Air	150	112.5	NA	90.7	Regional
Trans States Airlines	1,214	121.1	89.7	90.3	Regional
Chautauqua	5,898	127.9	89.9	90.2	Regional
Air Canada Jazz	6,422	128.3	90.5	90.2	Regional
Pinnacle Airlines	1,507	121.2	89.7	89.4	Regional

Source: Massport. 2011

1 Operations for some carriers differ to those in *Chapter 2, Activity Levels* and *Chapter 7, Air Quality/Emissions Reduction* because this table only includes jet aircraft and not turboprops, and because it includes both scheduled and unscheduled air carriers.

2 Delta acquired Northwest Airlines and 2010 is the first year of reported consolidated operations.

NA Airline had no operations at Logan Airport.

Dwell and Persistence Goals

Another supplemental measure of noise impact relates to the length of time noise impacts occur. To provide temporary relief to neighborhoods affected by regular overflights during single or multi-day periods, the PRAS Advisory Committee established two short-term goals for the system in addition to the annual goals:

- Provide relief from excessive dwell. Exceedance is defined as more than seven hours of operations over a given area during any day between the hours of 7:00 AM and midnight.
- Provide relief from excessive persistence. Exceedance is defined as more than 23 hours of operations over an area between 7:00 AM and midnight during a period of three consecutive days.

In contrast to the annual goals that count the number of equivalent operations on a runway, dwell and persistence are measured by the number of hours that a given location or area is subject to jet aircraft overflights. The PRAS Advisory Committee designated eight runway combinations for computing the effects of dwell and persistence on the communities. Table 6-12 shows the dwell and persistence areas by community.

Table 6-12 Representative Neighborhoods Affected by Runway Use

Runway	Representative Affected Neighborhoods
4L and 4R Arrivals	South Boston (Farragut St.), Dorchester, Quincy, Milton, Weymouth, and Braintree
32 and 33L Arrivals	Boston Harbor, Hull, Cohasset, Hingham, Scituate, and Norwell
14 and 15R Departures	Boston Harbor, Hull, Cohasset, Hingham, and Scituate
22L and 22R Departures	South Boston (Farragut Street), Boston Harbor, Hull, Cohasset, Hingham, and Scituate
27 Departures	South Boston (Fan Pier), Roxbury, Jamaica Plain, South End, West Roxbury, Roslindale, Brookline, and Hyde Park
4L and 4R Departures plus 22L and 22R Arrivals	East Boston (Bayswater, Orient Heights), Winthrop (Court Road), Revere, and Nahant
9 Departures plus 27 Arrivals	Winthrop (Point Shirley), and Boston Harbor
33 Departures plus 15 Arrivals	East Boston (Eagle Hill), Chelsea, Everett, Medford, Somerville, Arlington, and Cambridge

Source: Massport

As required by Massport's commitments for the Logan Airside Improvements Planning Project,[25] this *2011 ESPR* reports on noise dwell and persistence levels. Higher levels of dwell or persistence for overwater areas represent a benefit since this produces a corresponding decrease in total hours over populated areas. Figures 6-17 and 6-18 illustrate the annual hours of dwell and persistence by runway end for 2004 through 2011. In 2011, the largest contributor to dwell and persistence remained arrivals to Runway 27 and departures from Runway 9, and persistence and dwell both increased when compared to 2010. Dwell and persistence also increased for both arrivals and departures to Runway 22L and Runway 4R. Areas affected by arrivals to Runway 33L and Runway 32 as well as areas affected by departures from Runway 27 and Runway 33L showed a decrease in dwell and persistence.

25 *Logan Airside Improvements Planning Project Final EIS*, Section 4.2.3 *PRAS Monitoring and Reporting* June 2002.

Figure 6-17 Comparison of Annual Hours of Dwell Exceedance by Runway End, 2004 to 2011

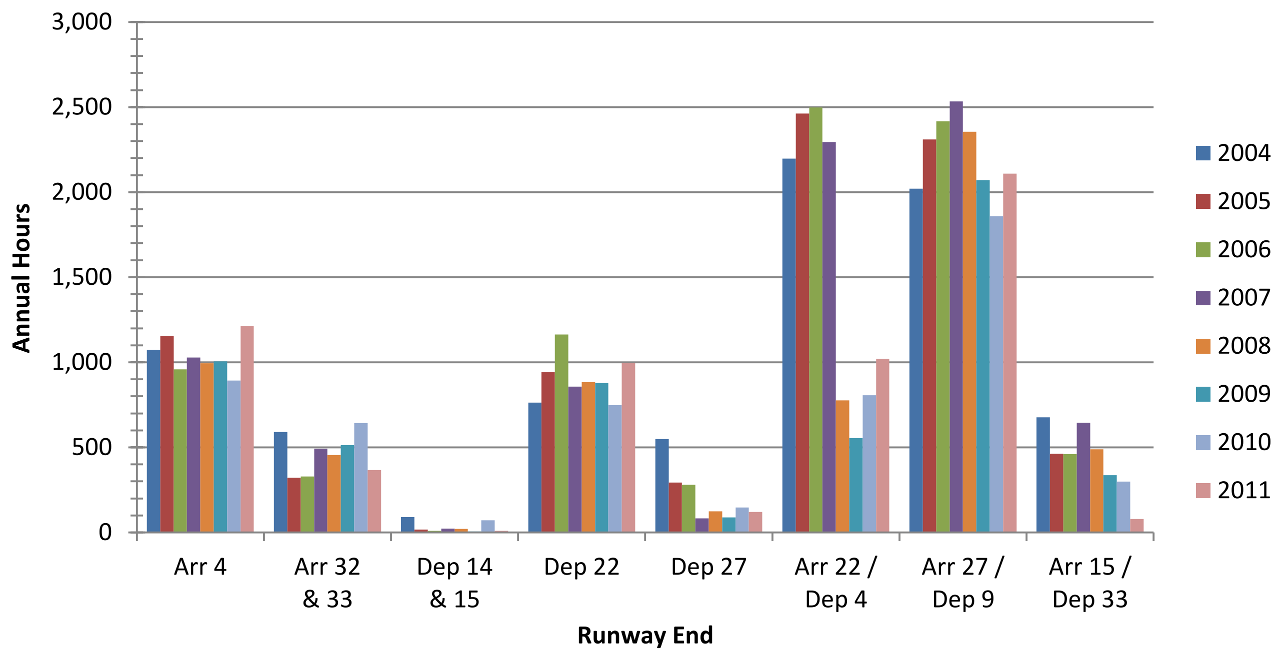
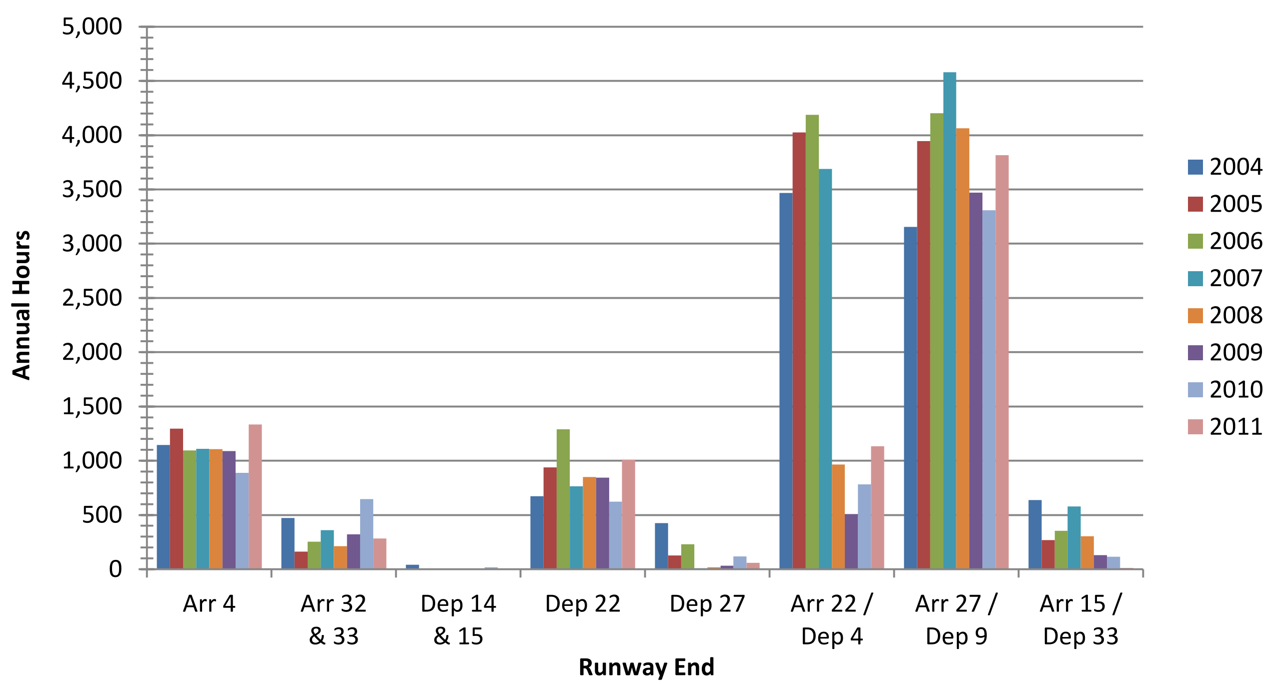


Figure 6-18 Comparison of Annual Hours of Persistence Exceedance by Runway End, 2004 to 2011



Notes: Arr – Arrivals
Dep – Departures

Time Above (TA)

The third supplemental noise metric reported in this *2011 ESPR* is the amount of time that aircraft noise is higher than each of three predefined threshold sound levels. The measure is referred to generally as TA, and the threshold sound levels used in the analysis are 65, 75, and 85 dBA (A-weighted dBs). Like DNL values, these times are computed using the FAA-approved INM as modified for Logan Airport. The calculations are made at each of Massport's permanent noise monitoring locations and are based on an average 24-hour day during the year as well as for the average nine-hour nighttime period from 10:00 PM to 7:00 AM. The threshold sound levels of 65, 75, and 85 dBA reflect different degrees of speech interference depending on factors such as whether people are outdoors, indoors with their windows open, or indoors with windows closed. Findings for 2011 include:

- The TA results at many of the sites correspond to the change in the contour levels. At Site 2, which is affected by Runway 27 departures (utilization for departures increased in 2011), the 24-hour TA65 level decreased from 14.2 minutes in 2010 to 11.1 minutes in 2011, however, the night only TA65 level increased from 0.1 minutes to 1.4 minutes suggesting the increase in departures on Runway 27 was primarily during the night.
- Site 16 (Revere – Bradstreet and Sales), which is affected by arrivals to Runways 22L and 4R departures, experienced an increase in the 24-hour TA65, TA75 and TA85 levels. The TA65 increased from 30.7 minutes in 2010 to 39.2 minutes in 2011 with the TA85 increasing from 1.9 minutes in 2010 to 2.3 minutes in 2011. The night only TA65 level increased 6.3 minutes in 2010 to 8.7 minutes in 2011. The increase in the TA values matches the measured increase from DNL 67.4 dB in 2010 to DNL 68.4 dB in 2011
- At Site 13 (East Boston High School), TA values dropped in 2011 compared to 2010. The TA65 dropped from 29.4 minutes to 15.1 minutes and the TA75 dropped from 6.1 minutes to 2.6 minutes.
- The average 24-hour TA results for 2011 decreased from 2010 for all levels. TA85 decreased on average by 0.1 minute due. The TA75 dropped by 1.6 minutes and the TA65 dropped by 9.4 minutes. Table 6-14 contains the night only TA results and the average results also dropped for 2011. This result is consistent with the decrease use of the noise abatement runway (Runway 15R-33L) due to the runway closure as many sites are affected by noise from Runway 15R-33L.

Table 6-13 and Table 6-14 present a summary of the calculated TA values for 2011.

Table 6-13 Time Above dBA Thresholds in a 24 Hour Period for Average Day[1]

Location	Site	Distance from Logan Airport (miles)	Minutes above Threshold 2010			Minutes above Threshold 2011			2011 Modeled Day-Night Sound Levels[2]
			85dBA	75dBA	65dBA	85dBA	75dBA	65dBA	
Winthrop – Bayview and Grandview	4	1.6	11.5	41.0	91.0	12.1	46.9	105.2	73.1
Winthrop – Harborview and Faun Bar	5	1.9	0.3	10.6	72.4	0.1	12.8	86.8	64.3
Winthrop – Somerset near Johnson	6	0.8	0.0	3.5	79.9	0.0	0.2	11.8	61.8
Winthrop – Loring Road near Court	7	1.0	2.3	22.9	128.5	0.3	7.2	48.9	69.2
Winthrop – Morton and Amelia	8	1.6	0.1	3.0	46.9	0.1	2.6	24.4	62
East Boston – Bayswater near Annavoy	9	1.3	2.0	20.4	67.0	2.1	17.3	48.8	70.6
East Boston – Bayswater near Shawsheen	10	1.3	0.3	5.6	39.8	0.2	4.1	30.6	62.7
East Boston – Selma and Orient	11	1.8	0.0	1.4	20.5	0.0	1.0	9.7	54.5
East Boston Yacht Club	12	1.2	0.8	30.2	153.3	0.1	1.8	49.4	67.2
East Boston High School	13	1.9	0.3	6.1	29.4	0.1	2.6	15.1	59.4
East Boston – Jeffries Point Yacht Club	14	1.2	0.0	0.5	8.8	0.0	0.4	6.8	55.1
East Boston – Piers Park	30	1.5	0.0	0.3	4.2	0.0	0.2	3.1	52.4
Chelsea – Admiral's Hill	15	2.8	0.2	4.1	25.0	0.1	1.6	12.6	57.4
Revere – Bradstreet and Sales	16	2.4	1.9	12.4	30.7	2.3	15.7	39.2	68.4
Revere – Carey Circle	17	5.3	0.0	1.6	21.3	0.0	1.8	28.0	59.3
Nahant – U.S.C.G. Recreational Facility	18	5.9	0.0	0.0	0.7	0.0	0.0	0.3	45.0
Everett – Tremont near Prescott	21	4.5	0.0	0.2	6.6	0.0	0.1	3.0	49.1
Medford – Magoun near Thatcher	22	6.0	0.0	0.2	5.8	0.0	0.1	2.7	49.0
Swampscott – Smith Lane	19	8.7	0.0	0.0	1.7	0.0	0.0	1.0	45.6
Lynn - Pond and Towns Court	20	8.4	0.0	0.0	4.3	0.0	0.0	6.5	52.5
South End – Andrews Street	1	3.7	0.0	0.4	6.7	0.0	0.1	5.3	51.1
South Boston – B and Bolton	2	2.9	0.1	1.9	14.5	0.0	1.0	11.1	55.4
South Boston – Day Blvd. near Farragut	3	2.5	0.1	3.9	39.2	0.2	5.4	58.8	61.2
Roxbury – Boston Latin Academy	27	5.3	0.0	0.3	7.0	0.0	0.1	4.7	50.2
Jamaica Plain - Southbourne Road	28	7.7	0.0	0.0	2.2	0.0	0.0	1.1	46.5
Mattapan – Lewenburg School	29	7.3	0.0	0.0	0.8	0.0	0.0	0.7	44.9
Dorchester – Myrtlebank near Hilltop	23	6.3	0.0	0.0	8.5	0.0	0.0	12.2	54.1
Milton – Cunningham Park near Fullers	24	8.1	0.0	0.0	9.1	0.0	0.0	14.1	54.0
Quincy – Squaw Rock Park	25	4.2	0.0	0.0	0.7	0.0	0.0	0.7	47.7
Hull – Hull High School near Channel Street	26	6.0	0.0	0.2	11.7	0.0	0.1	13.0	55.7
Average Time Above (TA) Value			0.7	5.7	31.3	0.6	4.1	21.9	57.1

Notes: Distance from Logan Airport calculated from the Airport Reference Point.
dBA A-weighted decibel
1 INMv7.0c for all of 2010 and 2011 (12 months) with adjusted database. (Database modifications as described in the *Logan Airport 2004 ESPR)*.
2 Modeled using RealContours™ and RealProfiles™ using INM v7.0c.

Table 6-13 Time Above dBA Thresholds in a Nine Hour Night Period for Average Day[1] (Continued)									
			Minutes above Threshold During the Night 2010			Minutes above Threshold During the Night 2011			
Location	Site	Distance from Logan Airport (miles)	85dBA	75dBA	65dBA	85dBA	75dBA	65dBA	2011 Modeled Day-Night Sound Levels[2]
Winthrop – Bayview and Grandview	4	1.6	0.6	2.4	5.9	0.9	3.5	8.3	73.1
Winthrop – Harborview and Faun Bar	5	1.9	0.0	0.6	4.4	0.0	1.1	6.9	64.3
Winthrop – Somerset near Johnson	6	0.8	0.0	0.4	10.2	0.0	0.0	1.8	61.8
Winthrop – Loring Road near Court	7	1.0	0.1	1.9	15.5	0.0	1.0	8.3	69.2
Winthrop – Morton and Amelia	8	1.6	0.0	0.3	6.4	0.0	0.3	4.8	62
East Boston – Bayswater near Annavoy	9	1.3	0.4	3.5	12.2	0.4	3.8	9.3	70.6
East Boston – Bayswater near Shawsheen	10	1.3	0.0	0.5	8.8	0.0	0.3	5.3	62.7
East Boston – Selma and Orient	11	1.8	0.0	0.1	3.1	0.0	0.0	0.6	54.5
East Boston Yacht Club	12	1.2	0.1	4.2	22.6	0.0	0.2	6.2	67.2
East Boston High School	13	1.9	0.1	0.8	3.3	0.0	0.5	2.4	59.4
East Boston – Jeffries Point Yacht Club	14	1.2	0.0	0.0	0.9	0.0	0.0	0.7	55.1
East Boston – Piers Park	30	1.5	0.0	0.1	3.2	0.0	0.0	0.2	52.4
Chelsea – Admiral's Hill	15	2.8	0.0	0.5	2.8	0.0	0.3	1.9	57.4
Revere – Bradstreet and Sales	16	2.4	0.5	2.7	6.3	0.6	3.7	8.7	68.4
Revere – Carey Circle	17	5.3	0.0	0.3	4.6	0.0	0.4	6.6	59.3
Nahant – U.S.C.G. Recreational Facility	18	5.9	0.0	0.0	0.0	0.0	0.0	0.0	45.0
Everett – Tremont near Prescott	21	4.5	0.0	0.0	1.2	0.0	0.0	0.4	49.1
Medford – Magoun near Thatcher	22	6.0	0.0	0.0	0.7	0.0	0.0	0.4	49.0
Swampscott – Smith Lane	19	8.7	0.0	0.0	0.1	0.0	0.0	0.1	45.6
Lynn - Pond and Towns Court	20	8.4	0.0	0.3	2.3	0.0	0.0	1.8	52.5
South End – Andrews Street	1	3.7	0.0	0.1	1.2	0.0	0.0	0.7	51.1
South Boston – B and Bolton	2	2.9	0.0	0.0	0.1	0.0	0.1	1.4	55.4
South Boston – Day Blvd. near Farragut	3	2.5	0.0	0.0	0.3	0.0	0.3	5.5	61.2
Roxbury – Boston Latin Academy	27	5.3	0.0	0.0	2.5	0.0	0.0	0.6	50.2
Jamaica Plain - Southbourne Road	28	7.7	0.0	0.0	1.2	0.0	0.0	0.1	46.5
Mattapan – Lewenburg School	29	7.3	0.0	0.0	0.4	0.0	0.0	0.0	44.9
Dorchester – Myrtlebank near Hilltop	23	6.3	0.0	0.0	0.6	0.0	0.0	1.2	54.1
Milton – Cunningham Park near Fullers	24	8.1	0.0	0.0	0.9	0.0	0.0	1.6	54.0
Quincy – Squaw Rock Park	25	4.2	0.0	0.0	1.1	0.0	0.0	0.1	47.7
Hull – Hull High School near Channel Street	26	6.0	0.0	0.0	0.0	0.0	0.0	2.5	55.7
Average Time Above Value			0.1	0.6	4.1	0.1	0.5	2.9	57.1

Source: HMMH

Notes: Distance from Logan Airport calculated from the Airport Reference Point.

dBA A-weighted decibel

1 INMv7.0c for all of 2011 (12 months) with adjusted database. (Database modifications as described in the *2004 ESPR)*.

2 Modeled using RealContours™ and RealProfiles™ using INM v7.0c.

2030 Noise Levels

The 2030 forecast of operations reported in this *2011 ESPR,* while greater than 2011, is lower than the level of operations seen in 2000 (1,355 daily operations in 2000 versus 1,301 daily operations for 2030). The 2030 fleet mix forecast includes a greater level of jet activity than non-jet activity compared to 2011 and 2000. The 2030 operations forecast, along with runway use assumptions developed from the FAA's BLANS No-action Total Airspace and Airport Modeler (TAAM) simulation modeling, were used to develop the 2030 noise contours. Flight tracks and track use were developed from the current RNAV radar data sets and were used for the 2030 modeling. These were used instead of RealContours™ as they would represent a higher predicted level of adherance to the advanced RNAV procedure design in 2030. In the 2011 modeling, there were aircraft flights which did not fly the RNAV procedures due to aircraft equipment and other factors. Using the model tracks developed to represent the RNAV procedures for 2030, a more represenatative forecast of the tracks was used. Only existing runways and procedures currently in place were used for the 2030 modeling. The following section provides the details of the modeling and the DNL results.

2030 Fleet Mix and Operations Assumptions

The long-range forecast developed for Logan Airport includes an increase in both passenger and cargo aircraft operations with a slight decrease in GA operations compared to 2011. The 2030 fleet, while larger, includes a larger percentage of newer aircraft (Boeing 787, 737 Max, Airbus 350, and Airbus Neo variants). These new aircraft types are projected to be more fuel efficient and generate less noise. The 2030 forecast projects 13.7 percent of the arrivals will be at night (up 0.9 perecent from 2011) with 10.9 percent of departures at night (a decrease of 0.2 percent from 2011).

Table 6-14 Modeled Daily Operations (2000, 2011, and 2030)

	Passenger and Cargo Aircraft							
	Stage 2 Jets		Stage 3 Jets		Non-Jet Aircraft		Total	
Year	Day	Night	Day	Night	Day	Night	Day	Night
2000	5.13	0.26	727.09	103.66	409.62	21.58	1,141.84	125.51
2011	0.01	0.00	684.19	109.38	135.18	4.73	819.39	114.11
2030	0.00	0.00	912.88	143.40	160.52	10.12	1,073.40	153.52
	General Aviation							
	Stage 2 Jets		Stage 3 Jets		Non-Jet Aircraft		Total	
Year	Day	Night	Day	Night	Day	Night	Day	Night
2000	7.29	0.64	40.08	3.21	34.57	1.83	81.94	5.68
2011	0.08	0.00	52.51	5.35	18.18	1.29	70.78	6.65
2030	0.00	0.00	53.63	5.15	13.63	1.31	67.26	6.46
	Total Operations							
	Stage 2 Jets		Stage 3 Jets		Non-Jet Aircraft		Total	
Year	Day	Night	Day	Night	Day	Night	Day	Night
2000	12.42	0.90	767.17	106.87	444.19	23.41	1,223.78	131.19
2011	0.09	0.00	736.7	114.73	153.36	6.02	890.17	120.76
2030	0.00	0.00	966.51	148.55	174.15	11.43	1,140.66	159.98

Source: 2011 data - HMMH and Massport's Noise Monitoring System.
2030 Massport Long-Range Forecast

The 2030 forecast assumes all Stage 2 jets and Stage 3 recertificated aircraft would be phased out by 2030. A small number of MD-80 aircraft are included in the forecast, however, the majority of the cargo fleet is made up of MD-11, A300-600 and B757 types. Table 6-14 summarizes the operations breakdowns by commercial and GA aircraft that are derived from this process.

Total operations are expected to increase by nearly 290 operations per day, from 1,011 per day in 2011 to 1,301 in 2030. Nighttime operations by commercial aircraft are projected to increase by 39.4 operations per night. Nighttime operations by GA aircraft are projected to remain similar to 2011.

Looking at historical trends, the 2030 forecast is similar to 2000 in total operations, however, there are several factors that are different. The Stage 2 aircraft present in the 2000 modeling are no longer in the fleet and the 2030 commercial operations are forecasted to have a much larger jet fleet than in 2000. There is also a higher number of operations forecasted to occur at night compared to 2000.

The runway use was determined from the TAAM modeling, which was developed by the FAA for the 2015 BLANS No-Action scenario. This simulation modeling includes a peak month average day of operations for 2015 of approximately 1,300 operations, which is very close to the 1,301 average annual day operations forecasted for 2030 (the peak month average day operations are typically scaled down to meet an annual average day operational level). The TAAM models the top seven runway configurations in use at the Airport. The use of each configuration during 2010 was applied to the TAAM results to generate the 2030 runway use.[26] A historical average of night runway use was developed using data from 2007 through 2009. The historical runway use was used in the 2030 modeling at night due to the fact that the simulation modeling was not optimized for the nighttime noise abatement procedures. The simulation modeling also includes use of the Centerfield Taxiway, Runway 14-32, and RNAV procedures implemented as of the end of 2011.[27]

The 2030 forecast fleet would primarily be comprised of jets which would result in the continued use of the largest capacity runway configurations and an increased use on the other runways. Table 6-15 compares the 2011 jet runway use to the forecast 2030 jet runway use, however, the 2011 use was skewed due to the closure of Runway 15R-33L for RSA improvements. Runway use for 2000 is also shown for context.

The modeled flight tracks for 2030 assume almost full use of the RNAV procedures and include the departure RNAV tracks from Runway 33L.[28]

26 The 2010 runway configuration percents were used as it represents the most recent year without runway closings.
27 The simulation includes the RNAV SIDS and the three new RNAV STARs.
28 Tracks were modified to represent the proposed action tracks shown in the Runway 33L RNAV SID Draft EA (January 14, 2013).

Table 6-15 Summary of Jet Aircraft Runway Use

Runway	2000 Departures[1]	2011 Departures[1]	2030 Departures[2]	Percent Change (2030 – 2011)	2000 Arrivals[1]	2011 Arrivals[1]	2030 Arrivals[2]	Percent Change (2030-2011)
4L	0%	0%	0%	0%	4%	7%	5%	(2%)
4R	8%	6%	4%	(2%)	40%	37%	29%	(8%)
9	35%	36%	31%	(5%)	0%	0%	0%	0%
14	--	<1%	0%	(<1%)	--	--	--	--
15L	--	--	--	--	--	--	--	--
15R	4%	5%	6%	1%	1%	<1%	1%	<1%
22L	3%	2%	4%	2%	7%	16%	17%	1%
22R	30%	36%	33%	(3%)	0%	0%	0%	0%
27	15%	7%	14%	7%	28%	28%	27%	(1%)
32	--	--	--	--	--	1%	1%	0%
33L	6%	7%	8%	1%	20%	11%	19%	8%
33R	--	--	--	--	--	--	--	--

Source: HMMH
Notes: Percentages in parentheses represent negative change.
1 Actual
2 Projected from the FAA BLANS TAAM Simulations

Use of the north-south runways for jet departures in 2030 would be 86 percent, or 1 percent less than in 2011 and 5 percent less than in 2000. Since the opening of Runway 14-32, the use of the north-south runways is 80 percent; 2011 was above average due to the Runway 15R-33L closure.

Departures for 2030 on Runways 4R , 9, and 22R would be slightly lower than 2011. Departures for 2030 on Runways 15R, 22L, 27 and 33L would be higher than 2011. Arrivals for 2030 on Runways, 4L, 4R, and 27 are predicted to be lower than for 2011 while there is forecast to be an increased use of Runways 22L, and 33L for arrivals in 2030. Similar to the year 2000, there is a higher use of Runways 27 and 33L for departures, the higher use of Runway 27 for departures is driven by the higher use of the Runway 33-27 configuration. In this configuration the majority of arrivals use Runway 33L and the majority of departures use Runway 27. The higher use of departures from Runway 33L is driven by the higher use of the Runway 27-33 configuration. Also for arrivals, the lower use of Runway 4L and 4R is due to the Runway 4-9 configuration which splits the arrivals between Runway 4L and Runway 4R with the majority of departures using Runway 9.

Population counts by contour interval are summarized in Table 6-16.[29] The higher level of operations in 2030 would result in the number of people exposed to noise levels being greater than or equal to DNL 65 dB to increase to 12,211. This is an increase from the 3,947 people exposed to noise levels greater than or equal to DNL 65 dB in 2011. However, this level is significantly less than the number exposed to DNL 65 dB or above in 2000 (the last year the daily operations were over 1,300), which was 17,745. Table 6-16 also shows that in the year 2000, a larger number of people were exposed to DNL 70 dB and above than is forecast in 2030 (352 in 2030 compared to 1,551 in 2000).

It is important to note that the 2030 DNL 65 dB contour remains within areas sound insulated by Massport that surround the Airport.

29 The 2011 and 2030 results are based on the 2010 U.S. Census with the 2000 results based on the 2000 Census data and the 1990 results based on the 1980 Census data.

Table 6-16 Noise-exposed Population by Community

Boston

Year	80+ DNL	75-80 DNL	70-75 DNL	65-70[1] DNL	Total (65+)
1990 (INM[3])	0	0	1,778	28,970	30,748
2000 (INM[3])	0	0	234	9,014[2]	9,248[2]
2011 (RC[4])	0	0	0	331[2]	331[2]
2030 (INM[3])	0	0	0	5,140	5,140

Revere

Year	80+ DNL	75-80 DNL	70-75 DNL	65-70[1] DNL	Total (65+)
1990 (INM[3])	0	0	0	4,274	4,274
2000 (INM[3])	0	0	0	2,496	2,496
2011 (RC[4])	0	0	0	2,547	2,547
2030 (INM[3])	0	0	0	2,975	2,975

Chelsea

Year	80+ DNL	75-80 DNL	70-75 DNL	65-70[1] DNL	Total (65+)
1990 (INM[3])	0	0	0	4,813	4,813
2000 (INM[3])	0	0	0	0	0
2011 (RC[4])	0	0	0	0	0
2030 (INM[3])	0	0	0	0	0

Winthrop

Year	80+ DNL	75-80 DNL	70-75 DNL	65-70[1] DNL	Total (65+)
1990 (INM[3])	0	676	1,211	2,420	4,307
2000 (INM[3])	0	247	1,070	4,684	6,001
2011 (RC[4])	0	0	130	939	1,069
2030 (INM[3])	0	0	352	3,744	4,096

Everett

Year	80+ DNL	75-80 DNL	70-75 DNL	65-70[1] DNL	Total (65+)
1990 (INM[3])	0	0	0	0	0
2000 (INM[3])	0	0	0	0	0
2011 (RC[4])	0	0	0	0	0
2030 (INM[3])	0	0	0	0	0

All Communities

Year	80+ DNL	75-80 DNL	70-75 DNL	65-70[1] DNL	Total (65+)
1990 (INM[3])	0	676	2,989	40,477	44,142
2000 (INM[3])	0	247	1,304	16,194[2]	17,745[2]
2011 (RC[4])	0	0	130	3,817[2]	3,947[2]
2030 (INM[3])	0	0	352	11,859	12,211

Source: HMMH
Notes: The 1990 population estimates are based on the 1980 census data, 2000 population estimates on the 2000 census data and 2011 and 2030 are based on the 2010 U.S. Census data.

1 DNL 65 dB is the Federally-defined noise criterion used as a guideline to identify when residential land use is considered incompatible with aircraft noise.
2 These values reflect the effect of the FAA-approved terrain adjustment in Orient Heights.
3 Standard INM
4 RealContours™

It is also important to note that the forecasted fleet for 2030 would have quieter and more efficient engines than flown today, however the modeling uses current versions of aircraft as "substitutes" for future types. Therefore, the 2030 DNL contours presented here are a conservative estimate of the future noise levels. It is expected with the continued advancement in aircraft technology resulting in quieter engines, the actual noise levels in 2030 would be lower.

While noise levels are forecast to increase from 2011 to 2030, they remain well below historical peaks, and the increase is focused on the DNL 65 to 70 dB level and not in the higher noise levels. The number of people in Boston, Winthrop and Revere exposed to sound levels DNL 65 dB are predicted to increase due to higher use of Runways 9, 22L, 22R, 27, 15R and 33L . The number of people within the DNL 70 to 75 dB contour in Winthrop would increase due to increased use of Runway 22L for departures and arrivals.

Figure 6-19 presents the comparison between the 2011 DNL contours and the predicted 2030 DNL contours. The DNL 60 dB contour for both years extends into the Point of Pines neighborhood and the 2030 contour extends farther into Winthrop than the 2011 contour. The 2030 contour extends farther south than the 2011 contour into Quincy and South Boston. To the west, the 2030 contour extends into Chelsea and encompasses the majority of East Boston. The DNL 65 dB contour is larger in all areas around the Airport. The DNL 65 dB contour extends to the north and is only

slightly larger than 2011 through Revere and east of Revere Beach. To the east, it extends into Winthrop farther than in 2011 along Court Road and in Point Shirley. To the south, the contour is very similar to the 2011 contour in South Boston over Pleasure Bay. To the west, the contour extends into East Boston almost to the Chelsea River. The contour is also larger over Boston Harbor extending out to Long Island.

In the 1990s, Massport developed a metric termed the Noise Per Seat Index which was designed to encourage the reduction of Stage 2 commercial jet aircraft in use at the airport. The Index level was set and then lowered each year. To reach the new level, airlines would switch to newer Stage 3 aircraft on their routes. The index was last set in 1998 since the Federal Government mandated the phase out of Stage 2 aircraft greater than 75,000 lbs by December 31, 1999. The FAA Reauthorization bill passed in early 2012 also mandates the phase out of Stage 2 aircraft with a takeoff weight less than 75,000 pounds by 2015.

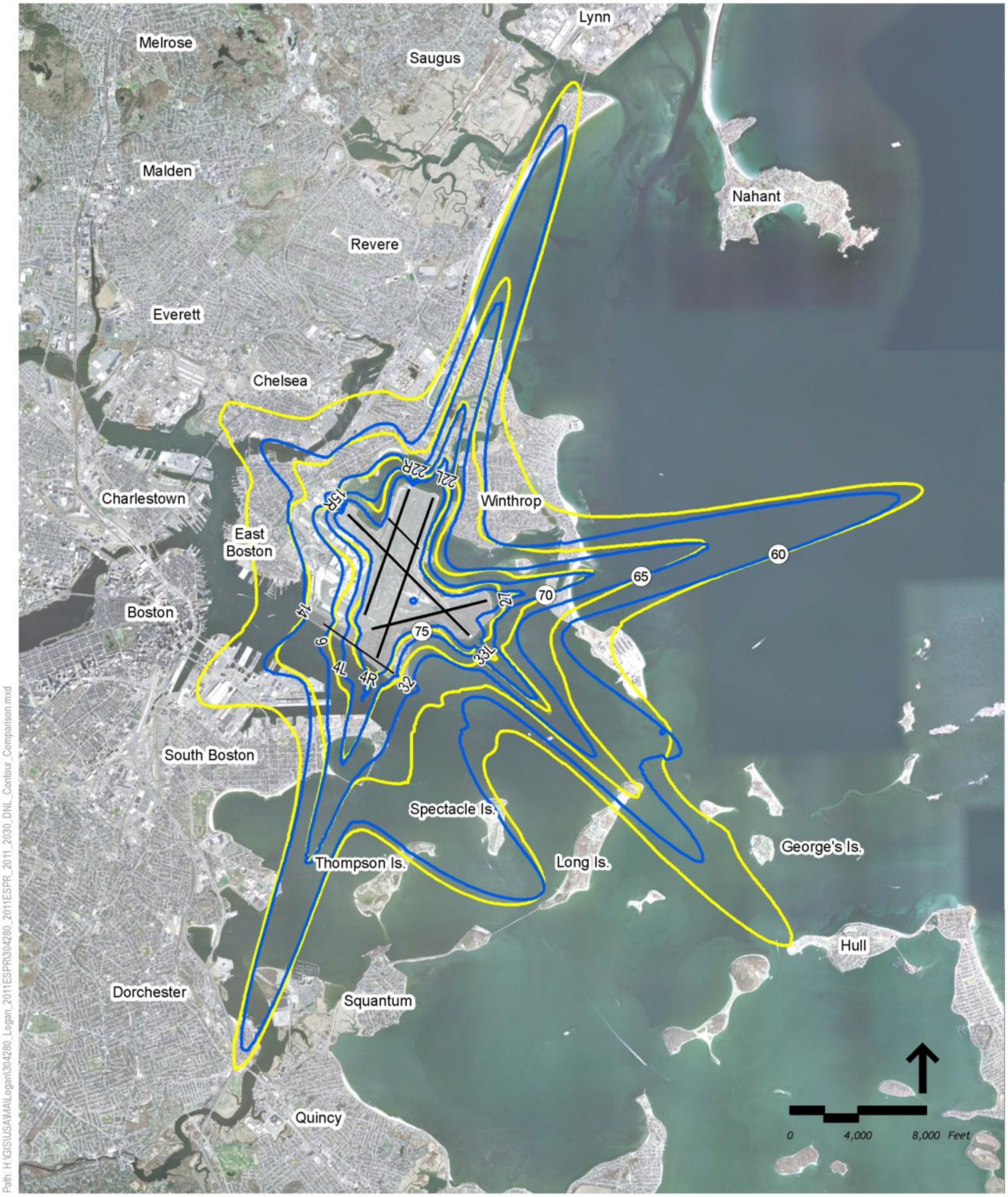
The index provided a decibel noise level per seat (NSPL). This is computed by using the number of operations, the number of seats per aircraft and the certificated noise levels for takeoffs and landings for each aircraft type. For comparison purposes. using this same method Massport computed the NPSL value for 2000, 2011 and 2030. These results are shown in Table 6-17.

Table 6-17 Noise Per Seat Level (NSPL)

Year	Jet Operations	Average Number of Seats per Aircraft	NSPL (dB EPNL)
2000	306,026	161.7	73.4
2011	283,320	133.1	72.0
2030	385,540	150.3	70.8

Source: HMMH

The NSPL analysis shows that in 2030, even with a higher level of commercial jet operations and higher seat levels per aircraft, the forecasted NSPL would be lower than in 2011. As shown in Table 6-17, the average number of sets decreased to 133.1 in 2011 primarily due to the use of RJs and smaller narrow-body aircraft on routes compared to 2000. This number increases by 2030 with the reduction of the small RJs and use of larger aircraft on routes. The NSPL continues to decline from 73.4 dB to 70.8 dB by 2030. The 2030 value is an estimate based on the lowest certificated values available today for the forecasted aircraft. It is expected that the aircraft operating in 2030 will actually have lower certificated values and that this noise level will be less than the 70.8 dB calculated.



Source: Massport NOMS / ERA Multi-Lat, MassGIS, USDA NAIP 2010

Comparison of the 60-75 dB DNL Contours for 2011 and 2030 with INM 7.0c

2011 DNL Contour (INM 7.0c)
2030 DNL Contour (INM 7.0c)

Figure 6-19

Historical Context and Trends

Noise levels at Logan Airport have decreased since 1990 due to changes at the Airport, efforts by Massport, and FAA, and improvements in aircraft technologies. Figure 6-20 presents the DNL 65 dB noise contours from every decade starting with 1980. The contours for 1980, 1990, 2000, and 2010 are from actual data and the predicted contours for 2030 were prepared for this *2011 ESPR*, respectively.

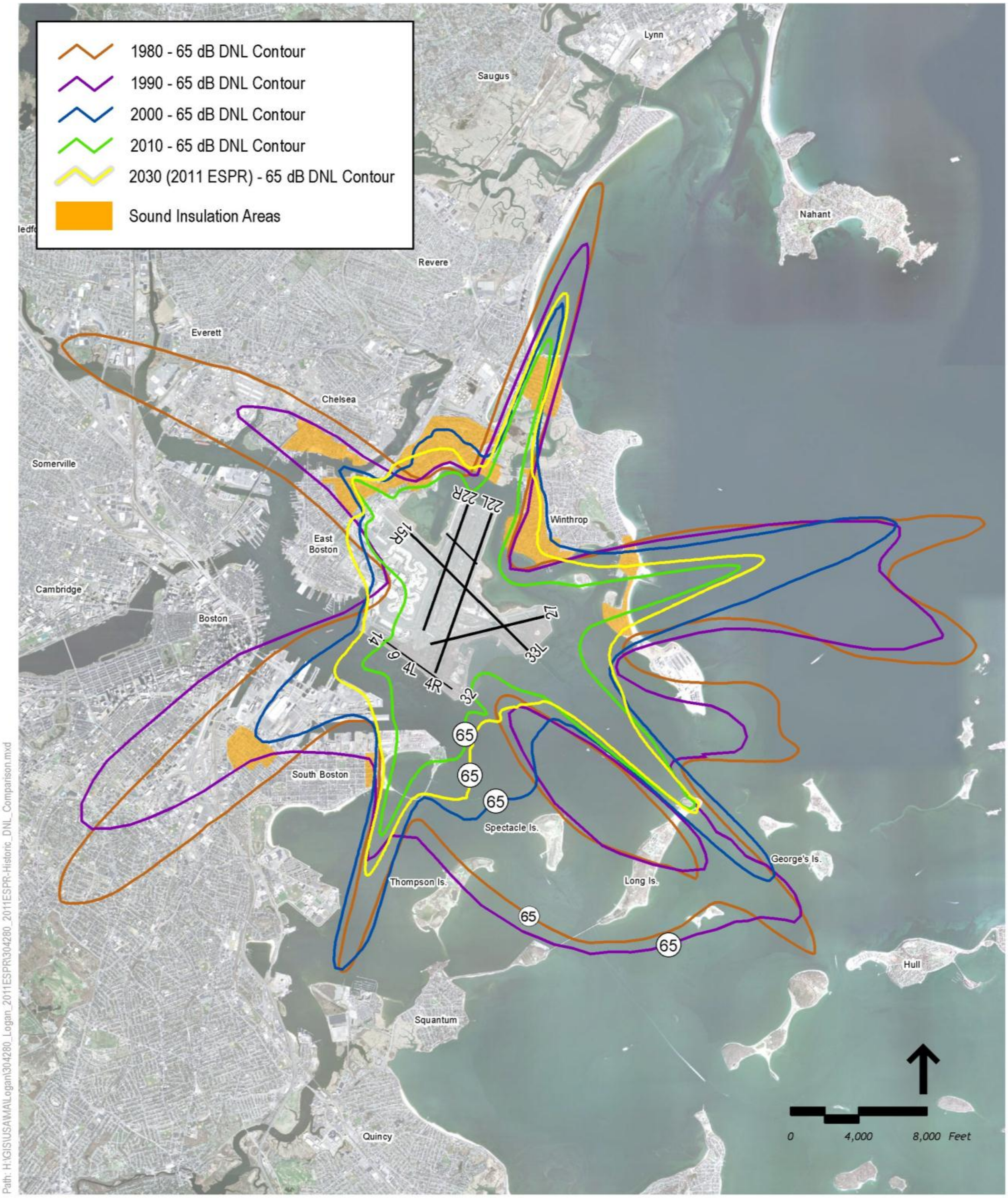
As shown in Table 6-18, the 1990 contour reflected an aircraft fleet where over 50 percent of the jets in the fleet were Stage 2 types and over 40 percent of the overall fleet was non-jet aircraft. The contour also shows the prior Runway 27 departure procedure (the current FAA procedure was implemented in 1996).

The 2000 contour contains a high level of recertificated aircraft and a much smaller Stage 2 fleet since all Stage 2 aircraft greater than 75,000 pounds were phased out by December 31, 1999. The contour also shows the change to the Runway 27 procedure and a higher use than today. The noise levels in East Boston were also higher due to the increase of the DNL 65 dB due to modeling of hill effects in Orient Heights (this adjustment is still made, however, it does not affect the DNL 65 dB contour).

Table 6-18 Modeled Average Daily Operations by Commercial and General Aviation Aircraft[1]

		1990	2000	2010	2030[1]
Commercial Aircraft					
Stage 2 Jets[2]	Day	312.4	5.13	0.01	0.00
	Night	19.99	0.26	0.01	0.00
	Total	**332.39**	**5.39**	**0.02**	**0.00**
Stage 3 Jets (All)	Day	288.89	727.09	674.25	912.88
	Night	57.25	103.66	107.92	143.40
	Total	**346.14**	**830.75**	**782.17**	**1,056.27**
Non-Jet Aircraft	Day	444.41	409.62	138.53	160.52
	Night	11.72	21.58	5.21	10.12
	Total	**456.13**	**431.2**	**143.74**	**170.65**
Total Commercial	Day	1,045.70	1,141.84	812.78	1,073.40
Operations	Night	88.96	125.51	113.13	153.52
	Total	**1,134.66**	**1,267.35**	**925.91**	**1,226.92**
GA Aircraft					
Total GA	Day	NA[3]	81.94	36.26	67.26
Operations	Night	NA[3]	5.68	3.97	6.46
	Total	**NA[3]**	**87.62**	**40.22**	**73.72**
Total	Day	1,045.70	1,223.78	849.03	1,140.66
	Night	88.96	131.19	117.1	159.98
	Total[1]	**1,134.66**	**1,354.97**	**966.13**	**1,300.64**

Source: HMMH
1 Predicted
2 Stage 2 aircraft are exempt from meeting newer federal Stage 3 noise limits when their certificated MGTOW is less than or equal to 75,000 pounds.
3 Totals prior to 1998 do not include GA operations.



Source: *Massport NOMS / ERA Multi-Lat, MassGIS, USDA NAIP 2010*
Note: The DNL 65 dB contour for 1980 and 1990 just northwest of Spectacle Island and over Long Island represents an area of noise lower than DNL 65 dB.

Comparison of Historical and Forecast 65 dB DNL Contours - 1980, 1990, 2000, 2010, and 2030

Figure 6-20

The 2010 contour included the addition of new Runway 14-32 and a reduced level of operations due to the economic recession as seen in Table 6-18.

The 2030 contour which is based on the latest forecast developed for Logan Airport includes a consistent level of non-jet operations (airlines such as Cape Air) and the continued reduction of small RJs. Even with the higher level of operations, it is important to note that the predicted 2030 contour is smaller than the 2000 contour in many areas. The exception to this is over areas of East Boston and over Revere where it is slightly larger than 2000; however the DNL 65 dB contour in 2030 extends into the areas where Massport has completed its residential sound insulation program. The 2030 contour also reflects the use of the RNAV procedures which were being implemented in 2010 and does not benefit from likely aircraft improvements.

Noise Abatement

Noise levels at Logan Airport have decreased in recent years due to a decrease in operations and quieter aircraft. Massport's noise abatement program continues to play a critical role in helping to limit and monitor noise impacts. Massport's emphasis on noise abatement has focused on the benefits of better analysis tools and improved modeling techniques to identify the causes of noise problems.

In 2008, the installation of a new Noise and Operations Management System (NOMS) was completed and after successful testing, the system was operationally accepted by Massport in 2009. Unlike the previous system, the new system is incorporated directly into Massport's computer network. Other important benefits of the new system include vastly improved analysis and mapping capabilities, better quality flight tracking data, use of multilateration radar (a separate and unique source of operational data), and direct correlation of noise events with radar flight paths and complaints (a feature that the prior system did not have). This latter capability is expected to further improve the ability of the system to differentiate between aircraft and community noise sources. All measured data and complaint information in this report were generated through the new NOMS.

Other continuing elements of Massport's noise mitigation program include:

- The Massport Noise Abatement Office, which was initiated in 1977. The Noise Office also maintains the noise section of the Massport website.[30] The site also provides information on Massport's sound insulation program, the Airport's noise monitoring system, various abatement measures, and other information of interest to the public.
- Preferred runway use designed to optimize over-water operations (especially during nighttime hours).
- RNAV flight tracks designed to avoid highly populated areas.
- An overwater visual approach used at night to keep aircraft offshore as much as possible.
- One of the most extensive residential and school sound insulation programs in the nation. To date, Massport has installed sound insulation in 5,374 residences, including 11,333 dwelling units, and 36 schools in East Boston, Roxbury, Dorchester, Winthrop, Revere, Chelsea, and South Boston.
- To initiate the process with each new sound insulation grant, Massport's RSIP representatives mail applications to eligible homeowners and often follow up with phone calls to encourage participation. Historically, the percentage of eligible homeowners who respond and whose dwellings are ultimately treated varies significantly by community from a high of nearly 90 percent in Revere to a low of about 50 percent in South Boston. Eighty to 85 percent of homeowners in East Boston and Winthrop typically

30 www.massport.com/environment/environmental_reporting/Noise%20Abatement/overview.aspx

participate. Approximately 8 percent of applicants also choose the Room-of-Preference option that allows the owner to identify a room (usually a bedroom or living room) for extra acoustical treatment.

- Massport has utilized a reach-back program where homes that are still within the eligible contour areas but have not participated in the RSIP were offered another chance to participate.
- The Massport RSIP program is almost complete and if the DNL contour expands into untreated areas Massport could apply to the FAA for funds to sound insulate these areas.
- Development of annual noise contours (Figure 6-14 presents the DNL 65 dB contours for 2010 and 2011).
- Continued support of a website that features an internet flight tracking system known as Airport Monitor (www.massport.com/environment/environmental_reporting/Noise%20Abatement/AirportMonitor.aspx). The site provides the general public with the opportunity to track individual flights to and from Logan Airport on a delayed basis. Tracking of noise complaints which can be entered online or by phone.
- Summary reports of operations by airline, runway, aircraft type, and other parameters that help the Noise Office track potential changes in the noise environment. Tables 6-11 and 6-14 are examples of these reports.

Commercial air carrier and cargo operators are deploying the newest engine technology at Logan Airport. Table 6-19 summarizes each airline operator and the percentage of its fleet that were originally manufactured as Stage 3 or Stage 4 aircraft. In 2011, the majority of the commercial air carrier and cargo operations are in aircraft which were originally manufactured as Stage 3 with a small percentage originally manufactured as Stage 4. Only three airlines of the 45 airlines listed were using aircraft originally manufactured as Stage 2 but have been recertificated to comply with Stage 3 requirements. Of the major cargo operators, UPS remained at 100 percent Stage 3 and Stage 4 operations, FedEx increased its share from 82 to 92 percent and DHL remained at 100 percent as it has phased out its fleet of older Boeing 727 aircraft.

Most of the charter operators remained similar to 2010 or increased their percentage of originally manufactured Stage 3 or Stage 4 aircraft operations. Only one major U.S. airline, Delta Air Lines, had a fleet which is not composed of 100 percent originally manufactured Stage 3 or Stage 4 aircraft operating at Logan Airport. Prior to the merger with Northwest Airlines, Delta Air Lines was using a fleet at 100 percent of originally manufactured Stage 3 or Stage 4 aircraft. In 2010, Northwest Airlines aircraft combined with Delta Air Lines' fleet, which caused the percentage to drop to 93 percent and they have increased to 97 percent in 2011. Only Capitol Cargo International had a fleet operating below 50 percent of originally manufactured Stage 3 or Stage 4 aircraft operations in 2011 but had fewer operations (225 operations).

Table 6-19 Percentage of Airline Operations in Original Stage 3 or 4 Aircraft[1] (2001 to 2011)

Airlines with more than 100 flights	Number of Flights 2011	Percentage of Original Stage 3 and 4 Operations[2]											100% Stage 3 or 4[3]
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
JetBlue Airways	63828	NA	NA	NA	100%	100%	100%	100%	100%	100%	100%	100%	✓
US Airways	40352	96%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Delta Air Lines[7]	28952	67%	75%	90%	100%	100%/87%	100%	100%	100%	100%	93%	97%	
American Airlines	21021	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
American Eagle Airlines	8816	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
United Air Lines	15305	100%	100%	90%	100%	100%	100%	100%	100%	100%	100%	100%	✓
AirTran Airways	12851	40%	93%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Southwest Airlines	17387	NA	NA	NA	NA	NA	NA	NA	NA	100%	100%	100%	✓
Continental	9821	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Delta Connection/Comair	7708	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Air Canada Jazz	6422	NA	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
AWAC - US Air Express	6491	NA	NA	NA	NA	NA	NA	NA	NA	100%	100%	100%	✓
US Airways Express/Republic	4365	NA	NA	NA	100%	100%	100%	100%	100%	100%	100%	100%	✓
Air Canada	6422	91%	90%	97%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Shuttle America Corp	3948	NA	NA	NA	NA	0%	0%	100%[6]	100%[6]	100%	100%	100%	✓
Virgin America	6052	NA	NA	NA	NA	NA	NA	NA	NA	100%	100%	100%	✓
FedEx	5050	66%	74%	76%	70%	72%	70%	71%	79%	83%	82%	92%	
Spirit Airlines	3054	NA	NA	NA	NA	NA	NA	NA	100%	100%	100%	100%	✓
Chautauqua	5898	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
British Airways	2409	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Alaska Airlines	1757	NA	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Lufthansa	1734	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Delta Connection/Atlantic SE	5088	NA	100%	100%	NA	NA	NA	NA	NA	NA	100%	100%	✓
United Parcel Service	1413	92%	97%	90%	94%	94%	98%	100%	100%	100%	100%	100%	✓
Pinnacle Airlines	1507	NA	NA	NA	NA	NA	100%	100%	100%	100%	100%	100%	✓
Aer Lingus	1126	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Mesaba Airlines	3117	NA	NA	NA	NA	NA	NA	NA	NA	NA	100%	100%	✓
Compass Airlines	1565	NA	NA	NA	NA	NA	NA	NA	100%	100%	100%	100%	✓
Air France	1013	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Icelandair	928	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Swiss Air	723	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Virgin Atlantic	6052	85%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Alitalia	604	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Frontier Airlines	445	100%	100%	100%	NA	NA	NA	NA	NA	NA	100%	100%	✓
DHL Airways	492	15%	6%	3%	0%	20%	1%[6]	1%	88%	95%	100%	100%	✓
Iberia Air Lines Of Spain	445	NA	NA	NA	NA	NA	100%	100%	100%	100%	100%	100%	✓
Mesa Airlines	260	NA	NA	100%	NA	0%	100%	100%	100%	100%	100%	100%	✓
Capital Cargo International[4]	225	NA	0%	0%	0%	0%	0%	7%	0%	0%	3%	0%	
SATA International Airlines	400	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	✓
Sun Country Airlines	513	100%	63%	100%	NA	NA	NA	NA	NA	100%	100%	100%	✓
TACV-Cabo Verde	236	NA	NA	100%	100%	NA	NA	NA	NA	100%	100%	100%	✓
Trans States Airlines	67	NA	NA	100%	100%	NA	NA	NA	NA	NA	100%	100%	✓
Bombardier Business Jet Solutions	69	NA	NA	NA	NA	NA	NA	NA	NA	100%	100%	100%	✓
Aeromexico	322	NA	NA	100%	100%	NA	NA	NA	NA	NA	100%	100%	✓
Miami Air	179	NA	29%	29%	78%	98%	91%	100%	100%	100%	100%	100%	✓

Source: Massport, 2011
1 Data was not reported prior to 2001.
2 Operations for some carriers differ with those in *Chapter 2, Activity Levels,* and *Chapter 7, Air Quality/Emissions Reduction* because the table only includes jet aircraft, not turboprops, and it includes scheduled and unscheduled air carriers.
3 Original Stage 3 or 4 means originally manufactured as a certificated Stage 3 or 4 aircraft under FAR Part 36.
4 No aircraft used at the Airport were New Stage 3 aircraft.
5 In 2006, DHL airways took over Airborne which had no New Stage 3 aircraft.
6 In 2008, Shuttle America Corp. began operating for Delta Connections.
7 Delta acquired Northwest Airlines and 2010 is the first year of reported consolidated operations. Numbers for 2009 and prior are provided for Delta Air Lines only. Separate data for Northwest Airlines for 2009 and prior are provided in the *2009 EDR.*

Noise Complaint Line

In 2011, Massport received a total of 3,280 noise complaints from 54 communities, a decrease of 12.8 percent from 2010, when the Noise Abatement Office received 3,761 complaints. In 2000, the level of noise complaints was much higher with 6,631 complaints. Table 6-20 is a summary of noise complaints from the Massport Noise Abatement Office. *Appendix H, Noise Abatement* has a full listing of the complaints by community. Four communities had more than 100 complaints from an individual caller, the most being 891 complaints from an individual in Winthrop. The other three individual callers who contacted the complaint line were from Lynn (468), Medford (275), and Weymouth (221). Among communities with more than 100 annual complaints, the greatest increases were Lynn (up from 339 to 469), Milton (up from 84 to 177), Weymouth (up from 193 to 228) and Winthrop (up from 207 to 1,147). Seven communities with more than 100 annual complaints in 2010 had a decrease in noise complaints for 2011: Cambridge (down from 323 in 2010 to 154 in 2011), Chelsea (down from 129 to 27), East Boston (down from 699 to 116), Jamaica Plain (down from 158 to 63), Medford (down from 444 to 297), Nahant (down from 204 to 74), and Somerville (down from 385 to 98).

Table 6-20 Noise Complaint Line Summary

	2010		2011		Change		2010		2011		Change
Town	Calls	Callers	Calls	Callers	(2010 to 2011)	Town	Calls	Callers	Calls	Callers	(2010 to 2011)
Jamaica Plain	158	15	63	6	(95)	Cambridge	323	38	154	10	(169)
Lynn	339	3	469	2	130	Chelsea	129	17	27	9	(102)
Milton	84	13	177	27	93	East Boston	699	52	116	34	(583)
Roslindale	73	5	3	2	(70)	Marshfield	13	1	21	6	8
Somerville	385	74	98	45	(287)	Medford	444	53	297	13	(147)
South Boston	59	26	53	24	(6)	Nahant	204	48	74	26	(130)
Weymouth	193	4	228	7	35	Winthrop	207	70	1,147	92	940

Source: Massport 2011

Boston Logan Airport Noise Study (BLANS)

The FAA's Record of Decision (ROD) approving construction of the new unidirectional Runway 14-32 required that the FAA, Massport, and the Community Advisory Committee (CAC) jointly undertake a study to determine whether changes to existing noise abatement flight track corridors might further reduce noise impacts. In addition, the Massachusetts Environmental Policy Act (MEPA) Certificate for the *Boston-Logan Airside Improvements Planning Environmental Impact Report (EIR)* directed Massport to work with the FAA and local communities on a review of the Logan Airport Preferential Runway Advisory System (PRAS).

This study is being conducted in multiple phases. Phase 1, which was known as The Boston Overflight Noise Study (BONS), was initiated in the winter of 2004 and was completed in fall of 2007. During Phase 1, 55 airspace and operational alternatives to reduce noise related to Logan Airport overflights were identified and screened for safety, operational, and noise benefits. Of the 55 alternatives, 13 measures were identified as potentially implementable in the near term. This phase was completed in 2007 and a National Environmental Policy Act (NEPA) Categorical Exclusion was issued by FAA in October 2007 for several flight path changes mostly along the northeast and southeast shores from the Airport.[31]

31 FAA Documented Categorical Exclusion Record of Decision, October 16, 2007.

The conventional and radar vectored[32] changes which could be implemented without airspace changes were implemented in February of 2008. RNAV and other changes began taking place in 2009 when FAA completed design of these procedures. RNAV procedures were published by FAA on October 22, 2009 and were implemented in 2010.

Eight new RNAV procedures were implemented by FAA in 2010 and 2011 for Runways 4R, 9, 15R, 22R and 22L. Under these procedures, aircraft immediately depart the Airport similar to existing procedures but then aircraft follow a precise path over Boston Harbor, then aircraft cross the shoreline and return back over land at a higher altitude than previous procedures.

- Starting on 2/1/2010 all six RNAV procedures were in use from Runway 9
- Starting on 5/3/2010 all six RNAV procedures were in use from Runway 4R
- Starting on 11/18/2010 all six RNAV procedures were in use from Runway 15R, 22R and 22L
- Starting on 3/10/2011 all eight RNAV procedures were is use from Runways 4R, 9, 15R, 22R and 22L
- Pending RNAV procedures from Runway 33L

On December 14, 2011, three new RNAV Standard Terminal Arrival Routes were also implemented by FAA. These concentrate arrivals on routes leading into the Logan Airport's airspace and improve efficiency of arrivals. These have little effect on the noise environment close to the Airport and the DNL contours. The Runway 33L departure is the last RNAV to be implemented. FAA completed an EA in January 2013, and the comment period for the EA was extended to March 15, 2013 (from February 15, 2013), with a 6-month reevaluation of the RNAV. All other major Logan Airport runways that are capable of accommodating RNAVs have been implemented by the FAA and are in operation today.

Phase 2 of BLANS, which began in late 2007, included consideration of 53 proposed arrival, departure and ground noise measures. After the first level of screening completed in 2009, thirty-two measures advanced to the next level of screening. Nine of these measures address ground noise issues, six are approach measures, and eleven address departure measures. The remaining measures address local air traffic issues such as helicopters and altitudes for Visual Flight Rules (VFR) flights. The Level 2 screening was completed in 2011 and of the 32 measures, 10 were passed on to Level 3, 5 were determined as completed and 17 were eliminated. The Level 3 analysis, which consists of noise modeling for each individual measure along with a change analysis against the future baseline was completed in 2012. The Level 3 Screening Report was published by the FAA in December 2012. Two of the flight measures were modified resulting in a total of 12 measures evaluated (2 measures are related to ground movements and 10 are related to flight procedures). Of these measures, eight were recommended for implementation by the CAC (the two ground movements and six flight procedures) and four flight procedures were rejected. The FAA and Massport reviewed the CAC recommendations and determined that the two ground measures would meet the criteria for implementation, however, the FAA determined that none of the flight procedures would meet the criteria for noise abatement under BLANS.

32 Radar vector is the heading issued to aircraft to provide guidance by radar.

The approved two measures, with their status, are described below:[33]

- **Preferred Location for Runups away from Communities**. Massport has already tested this measure and identified a new location at the end of Runway 32 to be used when operationally feasible.
- **Holding Area for Delayed Departures**. Massport is prepared to commit to working with the FAA to seek approval and funding (subject to FAA operations/safety approval, environmental review, Massport capital budget process, availability of FAA funds) for construction of a hold pad to allow for short term staging of aircraft at or near the midpoint of the airfield.

Runway 22R Analysis

In the fall of 2011, Massport, in response to community inquiry, conducted an analysis reviewing departures from Runway 22R at Logan Airport. The RNAV departure procedures were implemented by FAA late in 2010 as a result of the BLANS project and the analysis compared departures on Runway 22R from December 2009 through October 2010 (pre-RNAV) and December 2010 through October 2011 (Post-RNAV). The analysis showed that the new procedures were causing departures to fly a more gradual turn after departing the airport to reach the first RNAV fix location. This was placing aircraft closer to the South Boston community when compared to the pre-RNAV departures. Massport shared this information with the community and the FAA. The results of the analysis are presented in *Appendix H, Noise Abatement*.

Reduced Engine Taxiing

Single or reduced engine taxiing has the potential to reduce noise at Logan Airport. When used, the largest benefit is achieved by reducing the use of the engines on the side of the aircraft closest to the community; however, this is not always practicable due to airline procedures, taxiway routings, and safety considerations. Massport has reached out to the airlines and encouraged the use of this procedure whenever practicable. In 2009, Massachusetts Institute of Technology (MIT) in cooperation with Massport and FAA conducted a survey of pilots at Logan Airport and found that the procedure was widely used on arrivals but not frequently used on departures.[34] Key reasons cited for not using the procedure were safety-related or practical reasons such as a short taxi time. The survey indicated that for the procedure to be considered for arrivals, the taxi-in time would have to exceed 10 minutes and for departures, exceed 20 minutes. The average taxi-out times for Logan Airport for 2011 exceeded 20 minutes only during the 6:00 PM to 7:00 PM period and for arrivals the average taxi-in time never exceeded 10 minutes. The total average departure taxi out time at Logan Airport for 2011 is 18.2 minutes and the average taxi-in time is 7.0 minutes.[35]

Mandatory single engine taxiing was also one of the proposed measures in the BLANS but was rejected due to safety concerns, and it is currently being implemented as a voluntary measure. Another MIT study was completed in January 2011, which presented the field tests of a control strategy to minimize airport congestion at Logan Airport. The study determined a suggested rate to meter aircraft pushbacks from the gate, in order to prevent airport congestion and reduce the time that flights spend with engines on while taxiing to the runway. The 2011 study is included as *Appendix L, Demonstration of Reduced Airport Congestion through Pushback Rate Control.*

Massport's noise abatement goals are achieved through the implementation of multiple elements. Table 6-21 lists these goals and the associated plan elements, and reports on progress toward achieving these goals.

33 Boston Logan Airport Noise Study Level Three Screening Analysis, FAA, December 2012, Page E-3.
34 The full report was published in the *2009 EDR* in *Appendix L*.
35 FAA Aviation Performance Metrics: Avg. Taxi Time Analysis – Internet report –accessed 9/4/2012.

Table 6-21 Noise Abatement Management Plan

Noise Abatement Goal	Plan Elements	2011 Progress Report
Limit total aircraft noise	Limit on Cumulative Noise Index (CNI)	The CNI value for 2011 was 152.1 EPNdB, well below the cap of 156.5 EPNdB.
	Stage 3 percentage Requirement in Noise Rules	In 2011, Stage 3 operations represented 99 percent of Logan Airport's total commercial jet traffic. The few Stage 2 operations that occurred during the year were all older small corporate jets flown by charters or small cargo operators and because these aircraft were less than 75,000 pounds gross takeoff weight, they were in full compliance with FAR Part 91, but still prohibited from operating at Logan Airport during the hours of 11:00 PM to 7:00 AM.
Mitigate noise impacts	Residential Sound Insulation Program (RSIP)	114 dwelling units were sound insulated in 2011, bringing the total of treated dwelling units to 11,333 since the start of the program in 1986. See *Appendix H, Noise Abatement* for additional details.
	School Sound Insulation Program	36 eligible schools have been sound insulated since this program began.
	Noise Abatement Arrival and Departure Procedures	Flight track monitoring and data analysis were used to verify adherence to noise abatement flight procedures. See *Appendix H, Noise Abatement* for copies of the 2011 Monitoring Report.
	Preferential Runway Advisory System (PRAS) Runway End Use Goals	The PRAS computer system was last used early in 2004 but due to system changes is not in use. However, FAA and Massport continue to work toward the current goals. The PRAS goals are expected to be reevaluated as part of the BLANS.
	Runway Restrictions	Noise-based use restrictions 24 hours per day on departures from Runway 4L and arrivals on Runway 22R were continued.
	Reduced-Engine Taxiing	Voluntary use of reduced-engine taxiing is encouraged when appropriate and safe.
Improve Noise Monitoring System	Replace Existing Noise Monitors, Install Multilateration Antennas for Flight Track Monitoring, and Install New Robust Software	The Airscene noise monitoring system is completely installed and in use at Logan. The noise monitors provide 1/3 octave band data at all sites to aide with aircraft identification. Noise events, flight events, and complaints are all linked. Multilateration provides improved radar coverage near the ground to help in identification of aircraft and runway assignment.
Minimize nighttime noise	Nighttime Stage 2 Aircraft Prohibition	Prohibition on Stage 2 aircraft operations at Logan Airport between 11:00 PM and 7:00 AM was continued.
	Nighttime Runway Restrictions	Prohibitions on use of Runway 4L for departures and Runway 22R for arrivals between 11:00 PM and 6:00 AM were continued.
	Maximization of Late-Night Over-Water Operation	Efforts to maximize late-night over-water operations were continued. Use of Runway 15R for departures and Runway 33L for arrivals continued.
	Nighttime Engine Run-up and APU Restrictions	Restriction on nighttime engine run-ups and use of auxiliary power units (APUs) was continued.
Address/respond to noise issues and complaints	Noise Complaint Line	Massport continued operation of Noise Complaint Line, (617) 561-3333. In 2011, Massport's Noise Abatement Office responded to 3,280 calls from callers living in 54 communities. The Noise Abatement Office issued the 2011 Noise Report (see *Appendix H, Noise Abatement)*.
	Special Studies	Massport continued to provide technical assistance and analysis using noise monitoring system to support FAA and others in monitoring jet departure tracks from Runway 27.
		The BLANS is evaluating several flight and ground procedure modifications that may reduce noise to affected communities near Logan Airport. Phase 1 is complete and Phase 2 was completed in 2012.

Source: Massport

7

Air Quality/ Emissions Reduction

Introduction

This chapter describes the air quality conditions at Logan Airport in 2011 and compares them to air quality conditions in 2010 and anticipated future conditions in 2030. Massachusetts Port Authority's (Massport) updated forecast is for the long-range planning horizon, 2030. This *2011 Environmental Status and Planning Report (ESPR)* provides an opportunity to revisit previous forecasts completed in 2004 and update them based on current and predicted conditions. As such, the 2030 emission inventory is based on the likely future passenger activity levels, aircraft operations, and fleet mix. There will be opportunities to revisit the 2030 forecast based on the most current data available at the next ESPR cycle as necessary. For further information on the development of the 2030 long-range forecast, refer to *Chapter 2, Activity Levels.*

The emissions inventory provided in this chapter includes Airport-related volatile organic compounds (VOCs), oxides of nitrogen (NO_x), carbon monoxide (CO), and particulate matter (PM).[1] An emissions inventory of greenhouse gases (GHGs) for 2011 and 2030 is also included.

This chapter also presents an update of air quality monitoring data for nitrogen dioxide (NO_2) collected by Massport in the vicinity of Logan Airport during 2011. Status reports are provided on Massport's Air Quality Initiative (AQI) (a 15-year voluntary program with the goal of maintaining NO_x emissions at, or below, 1999 levels); the Massport Air Monitoring Study (a program that collected air quality data in the communities around Logan Airport before and after the new Centerfield Taxiway was constructed); and other Massport air quality and emissions reduction initiatives.

Massport implements many measures to reduce air pollutant and GHG emissions through use of alternative fuels and renewable energy sources, energy efficiency, sustainable facility designs, recycling, single engine taxi procedures, and improvements to airfield operations.

1 PM less than or equal to 10 microns (PM_{10}) and PM less than or equal to 2.5 microns ($PM_{2.5}$) are subsets of PM.

Key Findings

In 2011, the changes in estimated emissions inventory results were driven principally by the increase (4.6 percent) in the number of aircraft operations at Logan Airport compared to 2010, primarily in the jet aircraft and general aviation categories. Slight changes in ground-based aircraft taxi times, stationary source fuel usage, on-airport vehicle miles traveled (VMT), and vehicle speeds also affected the 2011 emissions inventory results.

Air quality conditions in 2011 were as follows:

- Total VOC emissions were 1,109 kilograms per day (kg/day), or 9 percent higher than 2010 levels, but still following a long-range (i.e., a period of over 20 years) downward trend decreasing by 38 percent since 2000 and almost 76 percent since 1990. This one-year increase is primarily due to the increase in aircraft landing and takeoff operations (LTOs) when compared to 2010 (176,322 LTOs in 2010 and 184,494 LTOs in 2011).
- Total emissions of NO_x were 4,077 kg/day, or 2 percent higher than 2010 levels. In 2011, total NO_x emissions at Logan Airport were approximately 29 percent lower than 2000 levels. Also, total NO_x emissions in 2011 were 707 tons per year (tpy) lower than Massport's 1999 AQI benchmark. This represents an overall decrease of 30 percent in NO_x emissions since 1999.
- Total emissions of CO were 6,919 kg/day, or 3 percent lower than 2010 levels and 53 percent lower than 2000 levels; following the same long-range downward trend as VOCs and NO_x.
- Total emissions of $PM_{10}/PM_{2.5}$ associated with Logan Airport increased in 2011 by approximately 5 percent to 67 kg/day compared to 2010 levels, but still following a long-range downward trend decreasing by 19 percent since 2005 (2005 is the first year that $PM_{10}/PM_{2.5}$ emissions were reported). This one-year increase is mostly attributable to the corresponding increase in stationary source use, particularly snow melters in conjunction with the unusually heavy snowfall in early 2011.
- Since 1999, there has been a continuing trend of decreasing NO_2 concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the vicinity of Logan Airport. In addition, the annual NO_2 concentrations at all monitoring locations in 2011 continued to be well within the National Ambient Air Quality Standards (NAAQS) for NO_2. As discussed in this chapter, the NO_2 monitoring program was discontinued in 2012.
- Massport's Air Quality Monitoring Study is now complete, having collected data on a variety of ambient air pollutants over a two-year period as a means of assessing any air quality changes attributable to the operation of the Centerfield Taxiway which was completed in 2009. The findings from this Study will be submitted to MassDEP in 2013, and reported in the next Logan Airport Environmental Data Report (EDR).
- This reporting year, 2011, marks the fifth consecutive year in which Massport has voluntarily prepared a GHG emissions inventory for the EDR/ESPR. The 2011 GHG emission inventory was prepared following methodological guidance by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP).[2] The 2011 inventory assigns GHG emissions based on ownership or control (whether it is controlled by Massport, the airlines or other airport tenants, or the general public). Total Logan Airport GHG emissions in 2011 were 5 percent higher than 2010 levels primarily due to the increase in aircraft operations and passenger vehicles accessing the Airport. Massport-related emissions represent only

2 Transportation Research Board, Airport Cooperative Research Program, ACRP Report 11, Project 02-06, *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories*. See http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_011.pdf for the full report.

12 percent of total GHG emissions at the Airport, tenant-based emissions represent approximately 68 percent, electrical consumption represents 14 percent; and passenger vehicle emissions represent 6 percent. This inventory is one of the three GHG emissions inventories Massport prepares annually; however, the other two only comprise stationary sources of GHGs and are filed with MassDEP and the U.S. Environmental Protection Agency (EPA) respectively.

For the assessment of 2030 air quality conditions, the number of aircraft operations is forecasted to increase by 29 percent compared to 2011 levels. The findings for the 2030 air quality emissions inventory include:

- While still below the historic peaks (there were 487,996 operations in 2000), the number of annual aircraft operations in 2030 is predicted to be approximately 475,000 while the number of operations in 2011 was approximately 370,000. However, the average aircraft taxi time is expected to be approximately 20 percent lower in 2030 based the Boston Logan Airport Noise Study (BLANS) No-action Total Airspace and Airport Modeler (TAAM) model.[3] This model simulates the use of the Airport for each of the main runway configurations based on the BLANS Future No-action scenario, the existing airfield layout, and existing NextGen improvements.[4] Use of this model is consistent with the 2030 noise analysis presented in *Chapter 6, Noise Abatement,* and the taxi times results are within the range of historical averages.[5]
- Since the current version of the Federal Aviation Administration's (FAA) Emissions and Dispersion Modeling System (EDMS) used for this *2011 ESPR* air quality emissions inventory does not reflect the anticipated significant design and operational improvements in aircraft engine technologies, alternative fuels, and aircraft operational measures, the estimated emission totals for 2030 are expected to be measurably less for all pollutants than the values predicted in this chapter. Technology changes are likely to lead to lower fuel use, improved combustion efficiencies and lower emissions.
- Total emissions of NO_x in 2030 are predicted to be 11 percent lower than in 2000 but 24 percent higher than in 2011. This increase is almost entirely a result of the changing aircraft fleet (i.e., greater use of quieter Stage 3, higher NO_x-emitting aircraft) and the forecasted increase in operations at the Airport. However, compared to the AQI, NO_x emissions in 2030 are still shown to be 13 percent lower than 1999 levels – the benchmark for these emissions. The number of aircraft operations in 1999 was 494,816, about 4 percent higher than is predicted in 2030.
- Total emissions of VOCs in 2030 are predicted to be 36 percent lower than in 2000; however, it is 2 percent higher compared to 2011. This small increase is mostly attributable to the forecasted increase in aircraft operations and anticipated increase in the number of vehicle trips of passengers, employees and other airport users.
- Total emissions of CO in 2030 are predicted to be 52 percent lower than in 2000 and 11 percent lower compared to 2011. This overall reduction is due to anticipated decreased aircraft taxi times and likely tighter emission controls for motor vehicles and off road-vehicles such as ground service equipment (GSE).
- Total emissions of $PM_{10}/PM_{2.5}$ in 2030 are predicted to be 22 percent lower than 2005 levels (2005 is the first year that $PM_{10}/PM_{2.5}$ emissions were reported), and 3 percent lower than 2011. This decrease since 2011 is mostly due to the lower emissions from GSE over this timeframe.

3 For more information on the BLANS and the TAAM model, please refer to *Chapter 6, Noise Abatement.*

4 The taxi times forecasted for 2030 are almost five minutes less than the times reported for 2011. This is due to several factors such as; the use of runway configurations (i.e. a higher use of a configuration with a lower taxi time), the simulation is run under optimal operating conditions, the simulation does not include delays in the National Airspace System or delays due to various weather conditions that may be experienced throughout the year.

5 The FAA reports that the four year (2007 – 2010) average taxi time under optimal conditions is 19.05 minutes and the total four year average taxi time is 25.81 minutes. The forecasted 2030 taxi time falls within this range.

- Total emissions of GHG in 2030 are predicted to be 11 percent higher than 2011 levels due, in part, to the predicted 29 percent increase in aircraft operations associated with a 38 percent forecast increase in passenger traffic, and an anticipated 3 percent increase in terminal space area and utilization. The GHG calculation includes consideration of greater efficiency in aircraft movements and improvements in combustion efficiency of motor vehicles and GSE.

Regulatory Framework

The federal Clean Air Act (CAA), the NAAQS, and similar state laws govern air quality conditions in Massachusetts. The NAAQS and the Massachusetts State Implementation Plan (SIP), promulgated to demonstrate compliance with the CAA (and its 1990 amendments), regulate air quality in the Boston metropolitan area and Massachusetts, and are discussed in the following section.

National Ambient Air Quality Standards

The EPA established NAAQS for a group of criteria air pollutants to protect public health, the environment, and the quality of life from the detrimental effects of air pollution. These NAAQS are set for the following seven pollutants: CO, lead (Pb), NO_2, ozone (O_3), PM_{10}, $PM_{2.5}$, and sulfur dioxide (SO_2). The NAAQS primary standards (designed to protect human health) and secondary standards (designed to protect human welfare) are summarized on Table 7-1.

Based on air monitoring data and in accordance with the CAA, all areas within Massachusetts are designated as *attainment*, *nonattainment*, *maintenance*, or *unclassifiable* with respect to the NAAQS.[6] An area with air quality better than the NAAQS is designated as attainment; an area with air quality worse than the NAAQS is designated as nonattainment; and an area that is in transition from nonattainment to attainment is designated as attainment/maintenance. An area may also be designated as unclassifiable when there is a temporary lack of data to form a basis for determining attainment status. Nonattainment areas can be further classified as extreme, severe, serious, moderate, and marginal by the degree of non-compliance with the NAAQS. The current attainment/nonattainment designations for the Boston metropolitan area are summarized in Table 7-2.

6 Environmental Protection Agency, *The Green Book Nonattainment Areas for Criteria Pollutants* (www.epa.gov/air/oaqps/greenbk/).

Table 7-1 National Ambient Air Quality Standards

Pollutant	Averaging Time	Standard ppm	Standard µg/m³	Notes:
Carbon Monoxide (CO)	1 hour	35	40,000	Not to be exceeded more than once a year.
	8 hour	9	10,000	Not to be exceeded more than once a year.
Lead (Pb)	Rolling 3-Month Average	—	0.15	Not to exceed this level. Final rule October 2008.
	Quarterly	—	1.5	The 1978 standard (1.5 µg/m³ as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
Nitrogen Dioxide (NO_2)	1 hour	0.100	188	The three-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm.
	Annual	0.053	100	Not to exceed this level.
Ozone (O_3)	8 hour[1]	0.08	157	The average of the annual 4th highest daily 8-hour maximum over a three-year period is not to exceed this level.
	8 hour[2]	0.075	147	The average of the annual 4th highest daily 8-hour maximum over a three-year period is not to exceed this level.
Particulate Matter with a diameter ≤ 10 µm (PM_{10})	24 hour	—	150	Not to be exceeded more than once a year on average over three years.
Particulate Matter with a diameter ≤ 2.5 µm ($PM_{2.5}$)	24 hour	—	35	The three-year average of the 98th percentile for each population-oriented monitor within an area is not to exceed this level.
	Annual	—	15	The three-year average of the weighted annual mean from single or multiple monitors within an area is not to exceed this level.
Sulfur Dioxide (SO_2)	1 hour	0.075	196	Final rule signed June 2, 2010. The three-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed this level.
	3 hour	0.5	1,300	Not to be exceeded more than once a year.
	24 hour	0.14	365	Not to be exceeded more than once a year. (The 24 hour standard was revoked as of June 2, 2010).
	Annual	0.03	80	Not to exceed this level. (The Annual standard was revoked as of June 2, 2010.)

Source: EPA, 2012(www.epa.gov/air/criteria.html).
1 The 1997 NAAQS for ozone.
2 The 2008 NAAQS for ozone.
ppm Parts per million
µg/m³ Micrograms per cubic meter

The Boston area is currently designated as attainment/maintenance for CO, indicating that it is in transition back to attainment for this pollutant. Historically, the entire Boston metropolitan area has been designated as attainment for all other criteria pollutants except O_3, for which it was designated as “moderate” nonattainment based on the 1997 eight-hour ozone standard (see Table 7-1). The O_3 nonattainment area consisted of 10 counties in Massachusetts (Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, and Worcester). Logan Airport is located in Suffolk County.

In May 2012, the EPA published a Clean Air Determination for the *Boston-Lawrence-Worcester* 1997 Eight-Hour Ozone Nonattainment Area, signifying that based on air monitoring data collected between 2007 through 2010, the area has now attained the 1997 eight-hour ozone standard.[7] In April 2012, EPA began implementing the 2008 eight-hour ozone standard and has determined, based on year 2008 through 2011 monitoring data, that the area is considered attainment/unclassifiable for the 2008 eight-hour ozone standard.[8]

Table 7-2 Attainment/Nonattainment Designations for the Boston Metropolitan Area

Pollutant	Designation
Carbon monoxide (CO)	Attainment/Maintenance[1]
Nitrogen Dioxides (NO_2)	Attainment
Ozone (Eight-hour, 1997 Standard)	Attainment[1]
Ozone (Eight-hour, 2008 Standard)	Attainment/Unclassifiable[2]
Particulate matter (PM_{10})	Attainment
Particulate matter ($PM_{2.5}$)	Attainment
Sulfur Dioxide (SO_2)	Attainment
Lead (Pb)	Attainment

Source: EPA, 2012 (www.epa.gov/air/oaqps/greenbk/).
1 The Boston area was previously designated nonattainment for this pollutant but has since attained compliance with the NAAQS. Maintenance plan requirements have yet to be established.
2 Attainment/Unclassifiable means that the initial data shows attainment but additional data is needed to verify longer term conditions.

State Implementation Plan (SIP)

A SIP is a state's regulatory plan for bringing nonattainment areas within that state into compliance with the NAAQS. As indicated previously, the entire Boston metropolitan area has until recently been designated as "moderate" nonattainment for the 1997 eight-hour O_3 standard, but has since received a Clean Air Determination from EPA classifying the area as "attainment." As long as the area continues to attain this standard, MassDEP is not required to comply with any outstanding SIP requirements. However, Maintenance Plan requirements stipulated under Section 110 of the federal CAA could eventually apply for the 1997 standard, but any associated rulemaking has yet to be promulgated. Additionally, as stated above, the area has been designated attainment/unclassifiable for the 2008 eight-hour O_3 standard, and accordingly SIP preparation relative to this standard is not required for the Boston area. The most current SIP submittals for the Boston area are summarized in Table 7-3.

7 Approval and Promulgation of Air Quality Implementation Plans; Massachusetts and New Hampshire; Determination of Attainment of the One-Hour and 1997 Eight-Hour Ozone Standards for Eastern Massachusetts. (77 FR 31496)

8 Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards; Implementation of the 2008 National Ambient Air Quality Standards for Ozone: Nonattainment Area Classifications Approach, Attainment Deadlines and Revocation of the 1997 Ozone Standards for Transportation Conformity Purposes; Final Rules (77 FR 30088).

Table 7-3 State Implementation Plan for Ozone

Standard	Title	Status	Comments
One-Hour	One-hour Ozone Attainment Demonstration for the Massachusetts Portion of the Boston-Lawrence-Worcester, Massachusetts-New Hampshire Ozone Nonattainment Area.	Published December 6, 2002, as final rule.	EPA approved this SIP revision and established an attainment date of November 15, 2007, for the entire multi-state nonattainment area. EPA has further determined that there are no additional obligations under the one-hour standard for this area.
Eight-Hour	Final Massachusetts State Implementation Plan To Demonstrate Attainment of the National Ambient Air Quality Standard for Ozone	Submitted to EPA, January 31, 2008, for approval.	This standard calls for the attainment of the 1997 eight-hour NAAQS for ozone by 2010 and focuses on the control of NO_x and VOCs as precursors to ozone. As of April 2012, EPA has determined that the Boston area is compliant with the 2008 standard, thus no SIP is required for eight-hour ozone.[1, 2]

Source: MassDEP (www.mass.gov/dep/air/priorities/sip.htm).

1 In 2007, the EPA promulgated a new eight-hour NAAQS for ozone. Informally called the “2008 standard” to differentiate it from the former “1997 standard”, this new standard is more strict (i.e., lower) than the former standard.

2 The original SIP established the Logan Airport Parking Freeze and the limit of 17,319 commercial and 3,373 employee spaces at the Airport in 2007, which was changed to 18,019 commercial and 2,673 employee spaces in 2011.

Logan Airport Air Quality Permits for Stationary Sources of Emissions

Massport was granted a Title V Air Quality Operating Permit for Logan Airport in September 2004. This permit covers all of the Massport-operated stationary sources including the Central Heating and Cooling Plant, snow melters, fuel dispensers, boilers, emergency electrical generators, and fuel storage tanks.

Methodology

For the purposes of the ESPR, the analysis of air emissions associated with Logan Airport operations includes the following source categories, each of which has its own assessment methodology, database, and assumptions as described.

- **Aircraft Emissions** — The FAA’s EDMS is the EPA-preferred and the FAA-required model for calculating aircraft emissions. Because the FAA continually improves the performance, precision and adaptability of the EDMS, the program is subject to regular updates and revisions. For this analysis, the most recent version, EDMS v5.1.3, was used to compute the 2011 (and 2030) Logan Airport emissions inventory.

  As with recent EDRs and ESPRs, the actual aircraft fleet mix at Logan Airport in 2011 was used as a model input to analyze annual conditions. In a few instances where the aircraft/engine type or combinations operating at Logan Airport were not available in the EDMS database, consistent with FAA guidance, substitutions were made based on the closest match of aircraft type and engine performance characteristic. Table I-4 in *Appendix I, Air Quality/Emissions Reduction* contains the data that were used, including aircraft type, engine, LTOs, and aircraft taxi/delay times. For the analysis, the aircraft are grouped into four categories: air carriers, cargo, commuter, and general aviation (GA) aircraft.

  Each LTO consists of taxiing, queuing, takeoff, climb out, approach, and landing operations. From 2010 to 2011, total LTOs increased by approximately 5 percent (176,322 to 184,494) overall with air carrier LTOs increasing by approximately 4 percent (111,032 to 115,116), commuter LTOs decreasing by approximately 5 percent (54,812 to 52,316), air cargo LTOs decreasing by approximately 7 percent (3,137 to 2,932), and GA increasing by approximately 92 percent (7,341 to 14,130).[9]

9 GA operations are recovering from the large declines experienced over the past two years and are returning to average levels at the Airport. These GA operations still represent only a small percentage (7.7 percent) of total operations at Logan Airport.

Aircraft taxi/delay times are based on data obtained from the FAA Aviation System Performance Metrics (ASPM) database for 2011.[10] According to this database, the average aircraft taxi/delay times at Logan Airport increased from 25.0 minutes to 25.2 minutes from 2010 to 2011, which is less than a 1 percent change. Minimizing aircraft taxi/delay times is beneficial for air quality since this reduces the time airplane engines are operating while on the ground.

- **Ground Service Equipment/Auxiliary Power Units** — Estimates of GSE emissions were based on EDMS emission factors and continue to reflect emission reductions attributable to Massport's Alternative Fuel Vehicle (AFV) Program and the conversion of Massport and/or tenant GSE and fleet vehicles to compressed natural gas (CNG) or electricity. Model input data are based on a new on-site GSE time-in-mode survey conducted in May 2012 at the Airport at part of the ESPR, combined with the most recent information regarding GSE fuel use (e.g., gasoline, diesel, CNG, liquid petroleum gas (LPG), and electric) from the Logan Airport Vehicle Aerodrome Permit Application documentation.[11]

- **Motor Vehicles** — Motor vehicle emission factors were obtained from the most recent version of EPA's MOBILE model (MOBILE6.2.03) combined with MassDEP-recommended motor vehicle fleet mix data, operating conditions, and other Massachusetts-specific input parameters. MOBILE is preferred by MassDEP and used to develop motor vehicle emissions budgets for the SIP. The MOBILE input/output files are included in *Appendix I, Air Quality/Emissions Reduction*. In addition, *Chapter 5, Ground Access to and from Logan Airport* of this *ESPR* provides a discussion of the VMT data used for this analysis. Starting with this *2011 ESPR*, VMT and vehicle speed data were predicted by the traffic simulation model, VISSIM.[12]

- **Other Sources** — Emissions associated with fuel storage and handling, the Central Heating and Cooling Plant, snow melters, generators, and fire training at Logan Airport were based on annual fuel throughput records for 2011, combined with appropriate EPA emission factors (e.g., compilation of Air Pollution Emission Factors AP-42 or emission factors obtained from NO_x Reasonably Available Control Technology [RACT] compliance testing). When compared to 2010, No. 2 fuel oil, No. 6 fuel oil, natural gas usage from boilers and diesel fuel from snow melter usage increased approximately 20 percent, 25 percent, 4 percent, and 87 percent, respectively. (The increased snow melter use is attributable to the unusually heavy snowfall in early 2011).

- **Particulate Matter** — Estimates of PM emissions associated with Logan Airport were first reported in the *2005 EDR* in response to the then recent availability of an FAA-updated method (e.g., *First Order Approximation*) for computing aircraft $PM_{10}/PM_{2.5}$ emission factors. $PM_{10}/PM_{2.5}$ emissions are now routinely reported in the EDRs/ESPRs including this *2011 ESPR*.

- **Greenhouse Gases** — GHG emissions were calculated in much the same way criteria pollutants were calculated - through the use of input data such as activity levels or material throughput rates (i.e., fuel usage, VMT, electrical consumption) that are applied to appropriate emission factors (i.e., in units of GHG emissions per gallon of fuel). Input data were either based on Massport records, or data and information derived from the EDMS v5.1.3. Emission factors were obtained from the U.S. Energy Information Administration (EIA), the International Panel on Climate Change (IPCC), and the EPA.

  Consistent with prior years, the 2011 GHG emissions inventory includes aircraft operations within the ground-based taxi-idle/delay mode and up to the top of the 3,000–foot LTO cycle.[13] Consistent with prior EDRs, GHG emissions associated with GSE/auxiliary power unit (APU), motor vehicles, a variety of stationary sources, and electricity usage were also included. Of note, Massport has direct ownership or

10 FAA Aviation System Performance Metrics (ASPM) database for 2011 (aspm.faa.gov/).

11 All vehicles and equipment (including GSE) that operate on the airfield must obtain a Logan Airport Vehicle Aerodrome Permit. The application form for this permit was modified in 2007 to request the fuel-type information (e.g., gasoline, diesel, CNG, LPG, and electric).

12 PTV America. (2011). Verkehr In Städen Simulationsmodell- VISSIM version 5.40 [computer software]. Portland, OR.

13 Following the guidance issued by the Airport Cooperative Research Program, ACRP Report 11, Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories.

control over a small percentage (approximately 12 percent) of these GHG emissions and their sources (i.e., limited to Massport fleet vehicles, on-airport roadways, stationary sources, and electrical consumption within Massport buildings). As with most commercial service airports, the vast majority of the emission sources at Logan Airport are owned or controlled by the airlines, other airport tenants, and the general public (motor vehicles). Massport undertakes a variety of program to reduce non-Massport emissions (by Airport tenants) through its support of HOV initiatives, including subsidizing free Silver Line Service through June 1, 2013, and supporting use of alternative fuels by airport taxis, the CNG station, and providing electric plug-ins for GSE, 400 Hz Power and pre-conditioned air at airplane gates.

Emissions Inventory in 2011

This section provides a summary of the 2011 Logan Airport emissions inventory for VOCs, CO, NO_x, and $PM_{10}/PM_{2.5}$. Emissions of O_3 are not directly computed as it is a secondary pollutant formed by the interactions of NO_x and VOCs throughout the region. Emissions of SO_2 and Pb are also not computed, as Logan Airport emission sources are not large generators of these two pollutants.

As stated above, the aircraft emissions inventory was prepared based on the actual number of aircraft operations (i.e., LTOs), fleet mix, and operational times-in-mode (TIM) at the Airport in 2011. Similarly, emissions associated with GSE, motor vehicles, fuel storage and transfer facilities, and a variety of stationary sources (i.e., boilers, snow melters, live-fire training, emergency generators, etc.) associated with Logan Airport were also computed based on actual conditions.

As in preceding ESPRs and EDRs, the results of the 2011 emissions inventory are compared with the results for 2010 and other previous years extending back to 1990. For ease of comparison in this ESPR, the summary figures now contain the previous results for 1990 and 2000 and then annually for 2005 to 2011.[14] However, to show the most recent data and to be consistent with other sections of the ESPR, the summary tables contain the results for 2000 through 2011. In this way, the changes in Logan Airport air quality conditions can be evaluated in both the short- and long-range time frame and on a common basis. For the AQI, estimates of 2015 NO_x emissions are also provided as a way of monitoring the progress of this voluntary emission management program. Finally, the results for the intervening years (i.e., 1995, 1996, 1997, etc.) are shown in previous EDRs and contained in *Appendix I, Air Quality/Emissions Reduction* of this ESPR.

Volatile Organic Compounds

In 2011, total VOC emissions at Logan Airport were 446 tpy (1,109 kg/day); an estimated increase of approximately 9 percent from 2010 levels. This calculated change is largely due to the increase in VOC emissions from aircraft engines associated with the 5 percent increase in aircraft operations and a 3 percent increase in VMT. However despite these increases, Figure 7-1 depicts an overall, long-range downward trend in VOC emissions at Logan Airport; since 1990, there has been a decrease of 76 percent. Figure 7-2 shows the 2011 percent breakdown of these emissions by source category. Table 7-4 shows the computed VOC emissions in kg/day for each emission source from 2000 to 2011. Other key findings include the following:

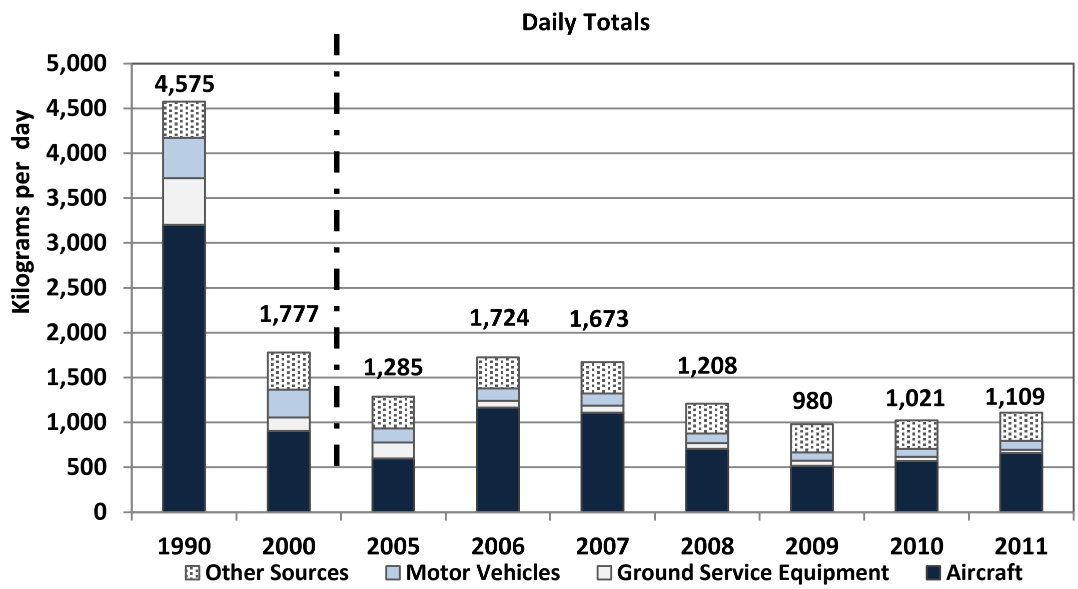
- Total aircraft-related VOC emissions were approximately 16 percent higher in 2011, when compared to 2010. This increase was largely due to the increase in aircraft LTOs, specifically, GA aircraft over this one-year period.

14 The results for the intervening years (i.e., 1995, 1996, 1997, etc.) are shown in previous EDRs and contained in *Appendix I, Air Quality/Emissions Reduction.*

- GSE-related VOC emissions were approximately 33 percent lower in 2011 than in 2010. This decrease was largely due to the changes in the GSE operating times based on the new GSE time-in-mode survey conducted at Logan Airport in May 2012.
- Total VOC emissions from motor vehicles in 2011 increased by 15 percent from 2010 levels. The increase in motor vehicle emissions is mostly attributable to higher emission factors of the 2011 motor vehicle fleet – an outcome of the lower speeds predicted by the VISSIM and an increase in VMT from 2010 to 2011.
- VOC emissions from stationary and other sources (e.g., fuel storage/handling, Central Heating and Cooling Plant, snow melter usage and firefighter training) remained virtually unchanged from 2010 to 2011. This is because Logan Airport ceased the use of VOC-containing deicing chemicals in 2010, which helped to offset the increase in stationary sources usage.

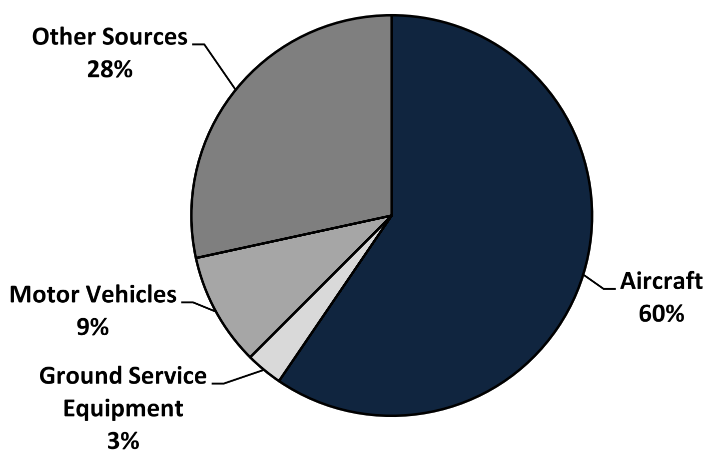
As Figure 7-2 shows, aircraft continue to represent the largest source (60 percent) of VOC emissions associated with Logan Airport, followed by stationary sources (28 percent), motor vehicles (9 percent), and GSE (3 percent). In summary, the 2011 results contained in Table 7-4 show a 9 percent increase of total emissions of VOCs when compared to 2010. However, the overall, long-range trend still shows a substantial decrease (38 percent) in these emissions since 2000.

Figure 7-1 Emissions of VOCs at Logan Airport



Note: Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.) and fueling sources.

Figure 7-2 Sources of VOC Emissions, 2011



Note: Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.) and fueling sources.

Table 7-4 Estimated VOC Emissions (in kg/day) at Logan Airport[1]

Aircraft/GSE Model:	EDMS v4.03		EDMS v4.11		EDMS v4.21	EDMS v4.5		EDMS v5.0.1		EDMS v5.0.2		EDMS v5.1		EDMS v5.1.2		EDMS v5.1.3	
Motor Vehicle Model:	**MOBILE 6.0**			**MOB 6.2.01**	**MOBILE 6.2.03**												
Year:	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**		**2007**		**2008**		**2009**		**2010**		**2011**
Aircraft Sources																	
Air carriers	514	374	248	208	292	271	227	511	435	381	324	286	237	235	292	292	305
Commuter aircraft	140	113	75	95	127	140	125	371	479	409	253	176	131	133	129	125	110
Cargo aircraft	207	149	127	94	110	41	19	46	129	112	107	70	71	71	70	70	69
General aviation	42	43	52	61	127	147	147	236	226	206	201	171	78	78	81	81	176
Total aircraft sources	903	679	502	458	656	599	518	1,164[2]	1,269	1,108	885	703	517	517	572	568	660
Ground Service Equipment[2]	153	143	247	227	187	178	167	77	78	78	66	66	56	56	49	49	33
Motor Vehicles																	
Ted Williams Tunnel through-traffic	12	10	9	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]
Parking/curbside[4]	89	77	51	45	38	37	33	33	31	31	25	25	22	22	20	20	20
On-airport vehicles	206	170	152	135	129	118	106	106	104	104	82	82	71	71	68	68	81
Total motor vehicle sources	307	257	212	180	167	155	139	139	135	135	107	107	93	93	88	88	101
Other Sources																	
Fuel storage/handling[5]	412	372	329	297	341	340	336	336	338	338	320	320	307	307	311	311	311
Miscellaneous sources[6]	2	2	2	3	9	13	8	8	14	14	13	12	7	7	5	5	4
Total other sources	414	374	331	300	350	353	344	344	352	352	333	332	314	314	316	316	315
Total Airport Sources	1,777	1,453	1,292	1,165	1,360	1,285	1,168	1,724	1,834	1,673	1,391	1,208	980	980	1,025	1,021	1,109

Source: Massport
Notes: Years 2006 to 2010 were computed with previous years EDMS version to provide for a common basis of comparison.
kg/day = kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 See *Appendix I, Air Quality/Emissions Reduction* for 1993 to 1999 emission inventory results.
2 The 2006 increase in aircraft VOC emissions is largely attributable to the addition of aircraft main engine startup emissions.
3 GSE emissions include aircraft APUs as well as vehicles and equipment converted to alternative fuels.
4 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.
5 Parking/curbside is based on VMT analysis.
6 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table 7-5 Estimated NO_X Emissions (in kg/day) at Logan Airport, 2000 – 2011[1]

Aircraft/GSE Model:	EDMS v4.03		EDMS v4.11		EDMS v4.21	EDMS v4.5		EDMS v5.0.1		EDMS v5.0.2		EDMS v5.1		EDMS v5.1.2		EDMS v5.1.3	
Motor Vehicle Model:	MOBILE 6.0			MOB 6.2.01	MOBILE 6.2.03												
Year:	2000	2001	2002	2003	2004	2005	2006		2007		2008		2009		2010		2011
Aircraft Sources																	
Air carriers	4,202	3,707	2,721	2,479	2,949	2,880	2,849	3,044	3,120	3,121	3,031	3,031	2,944	2,952	3,031	3,037	3,128
Commuter aircraft	125	233	208	185	245	225	195	256	353	354	319	319	309	234	203	204	199
Cargo aircraft	284	267	246	213	215	211	192	125	248	248	233	233	215	204	197	197	196
General aviation	49	34	38	45	49	50	49	60	56	56	43	43	27	23	29	26	43
Total aircraft sources	4,660	4,241	3,213	2,922	3,458	3,366	3,285	3,485	3,777	3,779	3,626	3,626	3,495	3,413	3,460	3,464	3,566
Ground Service Equipment[2]	333	305	322	291	333	312	280	300	299	299	257	257	219	219	198	198	173
Motor Vehicles																	
Ted Williams Tunnel through-traffic	26	22	20	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]
Parking/curbside[4]	52	46	32	28	21	22	19	19	18	18	15	15	13	13	12	12	11
On-airport vehicles	425	369	341	302	267	269	238	238	233	233	182	182	153	153	144	144	148
Total motor vehicle sources	503	437	393	330	288	291	257	257	251	251	197	197	166	166	156	156	159
Other Sources																	
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	211	185	175	151	211	218	109	109	128	128	124	124	181	181	166	166	179
Total other sources	211	185	175	151	211	218	109	109	128	128	124	124	181	181	166	166	179
Total Airport Sources	5,707	5,168	4,103	3,694	4,290	4,187	3,931	4,151	4,455	4,457	4,204	4,204	4,061	3,979	3,980	3,984	4,077

Source: Massport

Notes: Years 2006 to 2010 were computed with previous years EDMS version to provide for a common basis of comparison.
kg/day - kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).

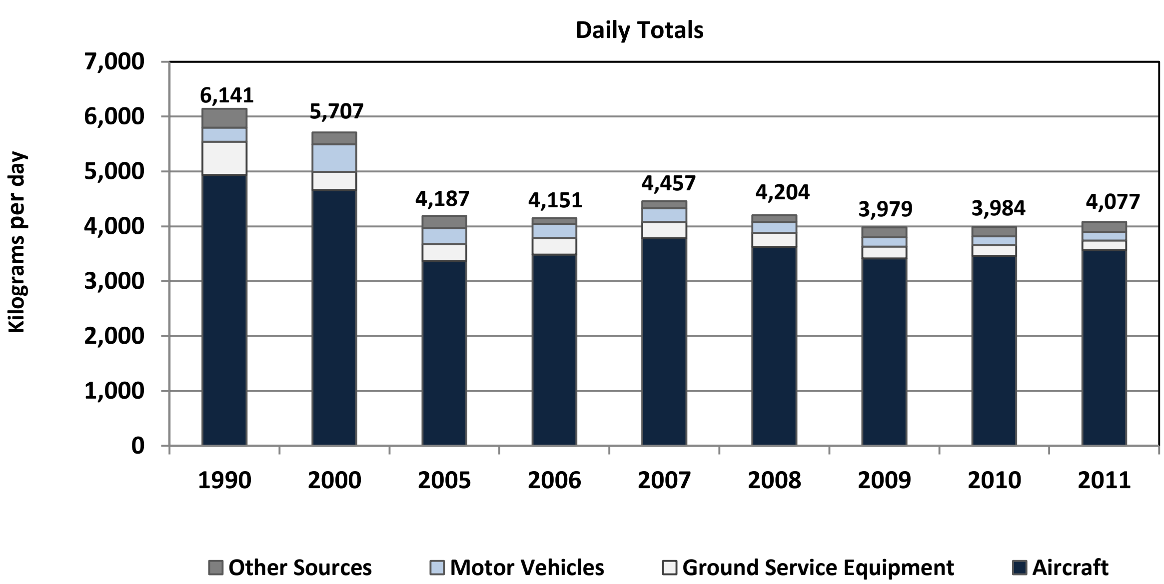
1 See *Appendix I, Air Quality/Emissions Reduction* for 1993 to 1999 emission inventory results.
2 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.
3 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.
4 Parking/curbside data is based on VMT analysis.
5 Fuel storage/handling facilities are not a source of NO_x emissions.
6 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Oxides of Nitrogen

In 2011, total NO_x emissions from all Airport-related sources were estimated to be 1,640 tpy (4,077 kg/day), which is a small increase of 2 percent from 2010 levels; however, this observation is within the context of an overall decrease of 30 percent from 1999 levels, the benchmark of the AQI which is discussed later in this chapter. Figure 7-3 depicts these short- and long-range trends in NO_x emissions and Table 7-5 shows the share for each emission source in 2000 through 2011. Other findings related to NO_x emissions include the following:

- When compared to 2010 levels, total aircraft-related NO_X emissions were 3 percent higher in 2011. This increase is largely due to the 5 percent increase in aircraft operations at Logan Airport, particularly in air carriers and GA operations while commuter and cargo aircraft emissions decreased due to 5 percent fewer operations by those categories of aircraft in 2011. Despite the NO_X emissions increase in 2011, the overall, long-range trend still shows a significant decrease (29 percent) in these emissions since 2000 and beyond.
- GSE emissions of NO_x decreased by 13 percent in 2011 compared to 2010, due mostly to the changes in GSE operating times reflected in the recent GSE time-in-mode survey.
- NO_x emissions from motor vehicles increased by approximately 2 percent from 2010 levels. This small increase is attributable mostly to higher emission factors of the 2011 motor vehicle fleet and an increase in VMT.
- Stationary sources show an increase of approximately 8 percent in NO_x emissions in 2011 compared to 2010, largely due to the higher usage of the snow melters attributable to the unusually high snowfall in early 2011. Additionally, the usage of No. 2 fuel oil, No. 6 fuel oil, and Tekflame at the fire training facility (FTF) also increased over this time period.

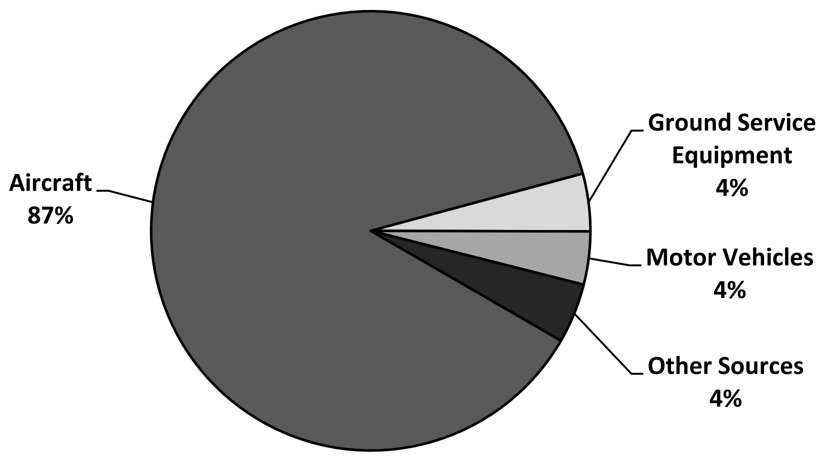
Figure 7-3 Emissions of NO_X at Logan Airport



Note: Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, firefighter training, etc.).

As shown in Figure 7-4, in 2011, aircraft continued to represent the largest source (87 percent) of NO_x at Logan Airport, followed by GSE (4 percent), motor vehicles (4 percent), and stationary sources (4 percent**).** In summary, the 2011 results contained in Table 7-5 show a 2 percent increase of total emissions of NOx when compared to 2010. However, the overall, long-range trend still shows a significant decrease (29 percent) in these emissions since 2000 and beyond.

Figure 7-4 Sources of NO_X Emissions, 2011



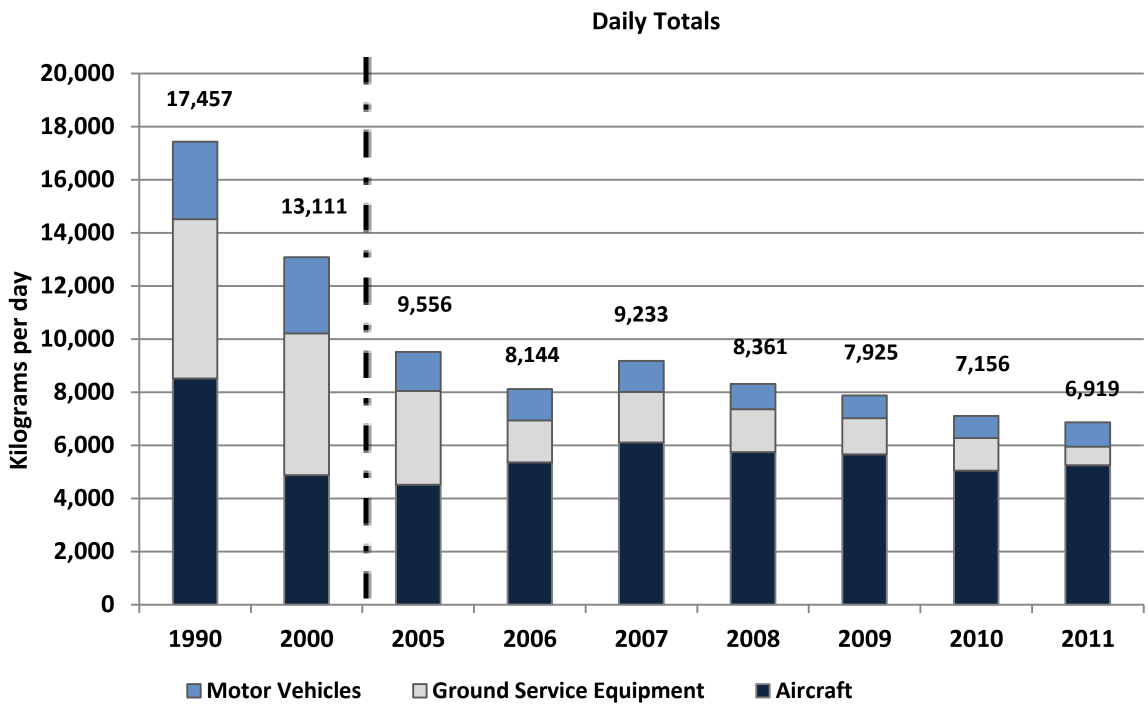
Note: Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.). Values may not add to 100 percent due to rounding.

Carbon Monoxide

Total CO emissions at Logan Airport in 2011 were 2,784 tpy (6,919 kg/day), or approximately 3 percent lower than 2010 levels. Figure 7-5 also depicts this long-range downward trend (i.e., a 60 percent overall reduction from 1990 to 2011) in CO emissions associated with airport activities. Table 7-6 also shows the breakdown of these emissions, by source category, for the years 2000 to 2011. The findings of the analysis reveal the following:

- Aircraft-related CO emissions increased in 2011 by approximately 4 percent compared to 2010 levels due mostly to the overall increase in aircraft operations at Logan Airport, particularly in air carriers and GA operations, as discussed above.
- GSE CO emissions decreased by approximately 43 percent in 2011 compared to 2010. This is mostly due to changes in the GSE operating times based on the 2012 GSE time-in-mode survey.
- CO emissions from motor vehicles increased in 2011 by approximately 10 percent from 2010 levels. This increase is attributable mostly to the higher emission factors of the 2011 motor vehicle fleet that reflect the lower speeds (i.e., emission factors are higher at lower vehicle speeds) predicted by the VISSIM and an increase in VMT.
- CO emissions from stationary sources increased approximately 11 percent in 2011 compared to 2010, largely due to the higher usage of snow melters associated with the unusually high snowfall in early 2011.

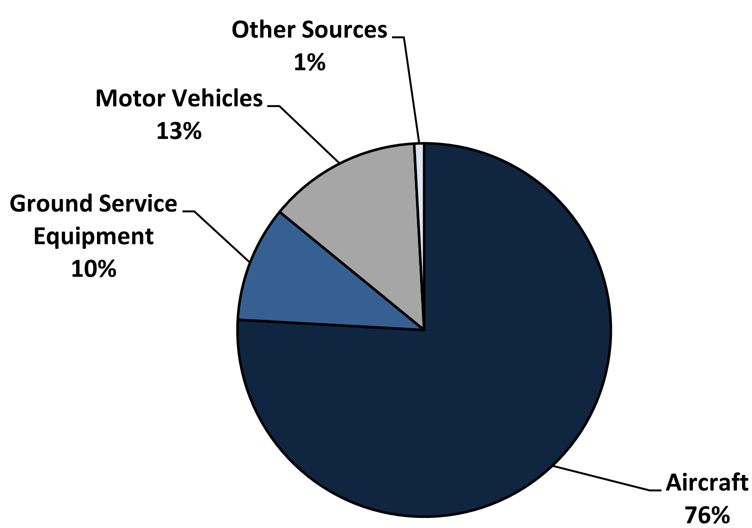
Figure 7-5 Emissions of CO at Logan Airport



Note: Other stationary sources not shown.

As shown in Figure 7-6, aircraft emissions continued to represent the largest source (76 percent) of CO at Logan Airport in 2011, followed by motor vehicles (13 percent), GSE (10 percent), and stationary sources (1 percent).

Figure 7-6 Sources of CO Emissions, 2011



Note: Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.).

The 2011 results contained in Table 7-6 show a 3 percent decrease of total emissions of CO when compared to 2010 and an overall, long-range downward trend of a 53 percent decrease in these emissions since 2000.

Particulate Matter (PM)

Table 7-7 shows that total estimated $PM_{10}/PM_{2.5}$ emissions at Logan Airport in 2011 were 27 tpy (67 kg/day), or approximately 5 percent higher than 2010 levels. However, there is still a measurable downward trend in these emissions, 19 percent lower since 2005 when they were first computed and reported in the *2005 EDR*. Other key findings of the analysis include the following:

- Aircraft-related $PM_{10}/PM_{2.5}$ emissions increased approximately 5 percent in 2011 compared to 2010 levels. This increase is due mostly to the overall increase in aircraft operations at Logan Airport, particularly in air carriers and GA operations.
- GSE $PM_{10}/PM_{2.5}$ emissions remained the same in 2011when compared to 2010 levels. This is mostly due to changes in the GSE operating times based on the recent GSE time-in-mode survey, which showed an increase in operating times of two of highest $PM_{10}/PM_{2.5}$ emitters (i.e., the diesel powered aircraft and baggage tugs and tractors).
- $PM_{10}/PM_{2.5}$ emissions from motor vehicles remained approximately the same in 2011 when compared to 2010 levels. This is attributable mostly to slightly lower emission factors (i.e., particulate matter emission factors are unaffected by the lower vehicle speeds in 2011) of the motor vehicle fleet offsetting the increased VMT over this time period.
- Stationary source emissions of $PM_{10}/PM_{2.5}$ increased by approximately 1 ton (1.5 percent of the overall total) compared with 2010, which is mostly attributable to the higher usage of the snow melters during the early winter of 2011.

Table 7-6 Estimated CO Emissions (in kg/day) at Logan Airport, 2000-2011[1]

Aircraft/GSE Model:	EDMS v4.03		EDMS v4.11		EDMS v4.21	EDMS v4.5		EDMS v5.0.1		EDMS v5.0.2		EDMS v5.1		EDMS v5.1.2		EDMS v5.1.3	
Motor Vehicle Model:	MOBILE 6.0			MOB 6.2.01	MOBILE 6.2.03												
Year:	2000	2001	2002	2003	2004	2005	2006		2007		2008		2009		2010		2011
Aircraft Sources																	
Air carriers	2,994	2,475	2,156	2,128	2,985	2,895	2,828	3,167	2,973	2,973	2,710	2,710	2,460	2,448	2,531	2,531	2,592
Commuter aircraft	1,188	1,072	783	846	1,010	1,010	950	1,587	2,484	2,484	2,436	2,436	2,364	2,795	2,629	2,086	2,042
Cargo aircraft	400	323	285	209	229	174	138	158	241	241	255	255	256	266	248	259	246
General aviation	295	407	256	276	416	437	398	442	401	403	345	345	145	150	177	173	370
Total aircraft sources	4,877	4,277	3,480	3,459	4,640	4,516	4,314	5,354	6,099	6,101	5,746	5,746	5,225	5,659	5,585	5,049	5,250
Ground Service Equipment[2]	5,335	5,193	5,170	4,758	3,586	3,531	3,409	1,586	1,904	1,904	1,609	1,609	1,364	1,364	1,222	1,222	694
Motor Vehicles																	
Ted Williams Tunnel through-traffic	133	121	112	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]
Parking/curbside[4]	495	440	295	253	180	179	144	144	139	139	117	117	107	107	106	106	110
On-airport vehicles	2,245	2,001	1,872	1,685	1,412	1,290	1,036	1,036	1,038	1,038	834	834	740	740	726	726	806
Total motor vehicle sources	2,873	2,562	2,279	1,938	1,592	1,469	1,180	1,180	1,177	1,177	951	951	847	847	832	832	916
Other Sources																	
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	27	24	23	22	33	40	24	24	51	51	55	55	55	55	53	53	59
Total other sources	27	24	23	22	33	40	24	24	51	51	55	55	55	55	53	53	59
Total Airport Sources	13,112	12,056	10,952	10,177	9,851	9,556	8,927	8,144	9,231	9,233	8,361	8,361	7,491	7,925	7,692	7,156	6,919

Source: Massport

Notes: Years 2006 to 2010 were computed with previous years EDMS version to provide for a common basis of comparison.

kg/day = kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).

1 See *Appendix I, Air Quality/Emissions Reduction* for 1993 to 1999 emission inventory results.

2 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.

3 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.

4 Parking/curbside information is based on VMT analysis.

5 Fuel storage/handling facilities are not a source of CO emissions.

6 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table 7-7 Estimated $PM_{10}/PM_{2.5}$ Emissions (in kg/day) at Logan Airport, 2005-2011[1]

Aircraft/GSE Model:	EDMS v4.5		EDMS v5.0.1		EDMS v5.0.2		EDMS v5.1		EDMS v5.1.2		EDMS v5.1.3	
Motor Vehicle Model:	**MOBILE 6.2.03**											
Year:	**2005[2]**	**2006**		**2007**		**2008**		**2009**		**2010**		**2011**
Aircraft Sources												
Air carriers	25	25	38	35	67	63	42	43	36	34	34	35
Commuter aircraft	1	1	2	6	14	11	6	5	5	4	4	3
Cargo aircraft	2	3	2	3	6	5	4	4	3	3	3	3
General aviation	2	2	2	2	5	5	4	2	2	2	2	4
Total aircraft sources	30	31	44	46	92	84	56	54	46	43	43	45
Ground Service Equipment[3]	11	9	9	10	10	8	15	14	14	13	13	13
Motor Vehicles												
Ted Williams Tunnel through-traffic	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]
Parking/curbside[5]	1	1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
On-airport vehicles	8	8	8	9	9	7	7	6	6	6	6	6
Total motor vehicle sources	9	9	9	9	9	7	7	6	6	6	6	6
Other Sources												
Fuel storage/handling[6]	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[7]	34	16	16	17	17	3	3	5	5	2	2	3
Total other sources	34	16	16	17	17	3	3	5	5	2	2	3
Total Airport Sources	84	65	78	82	128	102	81	79	71	64	64	67

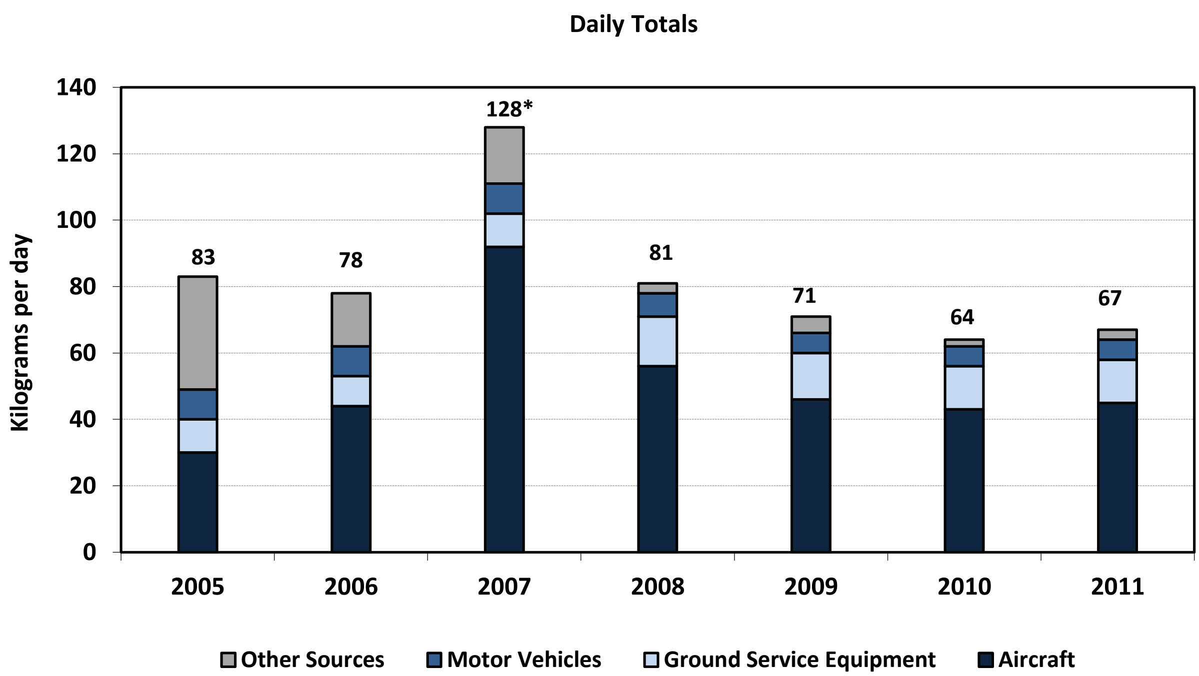
Source: Massport

Notes: Years 2006 to 2010 were computed with previous years EDMS version to provide for a common basis of comparison.
kg/day = kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy); PM - particulate matter

1 It is assumed that all PM are less than 2.5 microns in diameter ($PM_{2.5}$).
2 2005 is the first year that $PM_{10}/PM_{2.5}$ emissions were included in the Logan Airport ESPR/EDR emission inventories.
3 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.
4 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.
5 Parking/curbside is based on VTM analysis.
6 Fuel storage and handling facilities are not sources of PM emissions.
7 Includes the Central Heating and Cooling Plant, emergency electricity generation, fire training, snow melters, and other stationary sources.

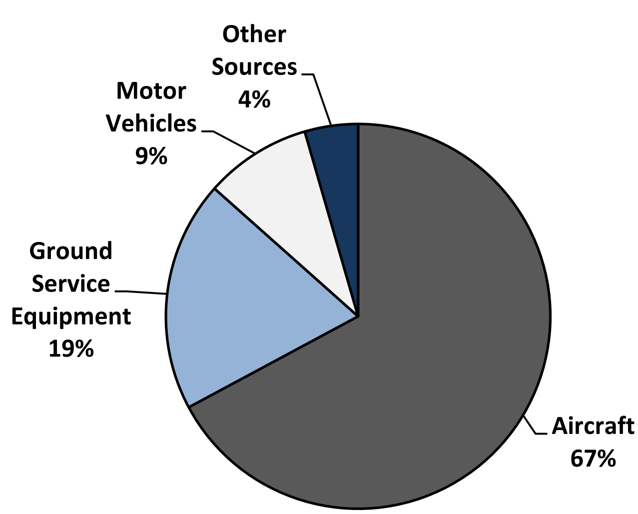
As shown in Figures 7-7 and 7-8, aircraft represent the largest source of $PM_{10}/PM_{2.5}$ (67 percent) followed by GSE (19 percent), motor vehicles (9 percent), and stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.) (4 percent). The 2011 results contained in Table 7-7 show a 5 percent increase of total emissions of VOCs when compared to 2010. However, the overall, long-range trend still shows a significant decrease (19 percent lower since 2005) in these emissions at Logan Airport.

Figure 7-7 Emissions of $PM_{10}/PM_{2.5}$ at Logan Airport, 2005-2011



Notes: Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.).
In 2007, 46 kg /day of PM emissions were attributable to changes in the EDMS model.

Figure 7-8 Sources of $PM_{10}/PM_{2.5}$ Emissions, 2011



Note: Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.). Values may not add to 100 percent due to rounding.

Projected Emissions Inventory for 2030

In 2012, Massport developed a long-range forecast for Logan Airport for 2030. Details are provided in *Chapter 2, Activity Levels*. The forecast number of aircraft operations for 2030 (474,734 operations) is nearly 30 percent greater than 2011 (368,987 operations), however, it is less than the level of operations in 2000 (487,996 operations). These forecasts, along with future Airport activity assumptions pertaining to airfield operating conditions, aircraft fleet mix, GSE and APU usage, and fuel throughput volumes were used to calculate the 2030 emissions inventory. A primary finding of the 2030 air quality analysis shows that although there are projected increases in emissions for most air quality parameters due to increased flights, the increases are still well below historical highs. In addition, the 2030 emission inventory represents a conservative analysis, and actual 2030 emissions are anticipated to be lower than the predicted values.

2030 Fleet Mix, Vehicle Miles Traveled (VMT), and Operations Assumptions

There are several limitations on the predictive ability of air quality models relating to years as distant as 2030. For example, the model used to conduct the aircraft and GSE analyses (i.e., EDMS) is often updated by FAA but does not anticipate future-year technological changes. The EDRs and ESPRs update assumptions and technological advances as they are available. The modeling used to calculate the 2030 emission inventory makes the following assumptions:

- As with the 2011 emissions inventory, the most recent version, EDMS v5.1.3, was used to compute the 2030 Logan Airport emissions inventory. While current aircraft and motor vehicle engine technologies are likely to change, become more efficient, and possibly use alternative fuels not used currently, these changes cannot feasibly be accounted for, and thus are not included in the model. Similarly, the modeled aircraft reflect current technologies and cannot adequately characterize the low-emissions profiles of certain developing engine technologies. Thus the predicted emissions represent a conservative (likely over estimate) of future conditions.
- LTOs from 2011 to 2030 are forecasted to increase by approximately 29 percent (184,494 to 237,367), with overall air carrier LTOs increasing by approximately 36 percent (115,116 to 156,361), commuter LTOs increasing by approximately 22 percent (52,316 to 63,734), air cargo LTOs increasing by approximately 30 percent (2,932 to 3,818), and GA decreasing by approximately 5 percent (14,130 to 13,454). Table I-4 in *Appendix I, Air Quality/Emissions Reduction* contains the input data that were used, including aircraft types, engines, LTOs, and assumed aircraft taxi/delay times.
- The estimation of GSE emissions was based on data from the 2012 on-site GSE time-in-mode survey. The 2030 emissions inventory uses current 2012 Alternative Fuel Vehicle statistics, as obtained from the Logan Airport Vehicle Aerodrome Permit Application process, to estimate GSE emissions in 2030, which reflects an over-estimate of emissions, since the percentage of alternative-fuel GSE is expected to be higher in 2030.
- Massport developed the 2030 taxi times from the BLANS TAAM simulation model which simulates the use of the Airport for each of the main runway configurations with a level of operations consistent with the 2030 forecast, the existing airfield layout, and existing NextGen improvements. The average taxi time forecasted for 2030 is approximately five minutes less than the times reported for 2011. This is due to several factors such as; the use of runway configurations (i.e., a higher use of a configuration with a lower taxi time), the simulation is run under optimal operating conditions, the simulation does not include delays in the National Airspace System or delays due to various weather conditions that may be experienced throughout the year. The simulation results are within historical averages. The FAA reports that the four year (2007 - 2010) average taxi time under optimal conditions is 19.05 minutes and the total four year average taxi time is 25.81 minutes. The forecasted 2030 taxi time falls within this range.

- As with 2011, motor vehicle emission factors for 2030 were obtained from the most recent version of EPA's MOBILE model (MOBILE6.2.03). The MOBILE input/output files are included in *Appendix I, Air Quality/Emissions Reduction*. The model assumes continued emissions improvements in motor vehicles. However, as engine technologies continue to evolve and become more fuel efficient with reduced emissions, future modeling is expected to show even smaller increases in emissions in 2030 than can be predicted today. *Chapter 5, Ground Access to and from Logan Airport,* of this *ESPR* provides a discussion of the VMT data used for this analysis. As with 2011, the VMT and vehicle speed data for 2030 were predicted by the traffic simulation model, VISSIM.
- Emissions associated with fuel storage and handling, the Central Heating and Cooling Plant, snow melters, generators, and fire training at Logan Airport are based largely on fuel throughput, and it is difficult to predict what the fuel usage will be in 2030. Emissions from boilers and generators were estimated by using the average fuel throughput for the last five years and increasing that by the anticipated increase in terminal building area, or 3 percent. Emissions from snow melters and fire training are anticipated to be relatively constant through 2030. The same emission factors used in 2011 were also assumed for 2030.

2030 Emissions Inventory Results

Due to the conservative nature of the modeling assumptions, the results of the 2030 emissions inventory, which are shown in Table 7-8, should be considered reasonable, but may be conservatively high, since the calculations are based on currently known information. As more accurate emissions data become available in the future, these results will be updated with future ESPRs.

Changes in emissions are a function of number of aircraft operations, fleet mix, taxi times, GSE emission factors, motor vehicle volumes and emission factors, stationary source fuel usage, and others. In some cases, these data result in opposite effects such as taxi times which influence aircraft VOC and CO, while NO_X is mostly influenced by the increase in the number of operations, and $PM_{10}/PM_{2.5}$ is influenced by GSE serving the aircraft fleet.

As shown, even with a nearly 30 percent forecasted increase in operations, total emissions of VOCs in 2030 are expected to be only 2 percent higher than in 2011 and 36 percent lower than in 2000. The small overall increase in VOC emissions is mainly attributed to the projected increase in fuel storage and handling, particularly jet fuel and gasoline, associated with the forecasted increase in operations and the number of motor vehicles accessing the Airport. Any increased use of lower emitting fuels would offset this small increase.

Total emissions of NO_X in 2030 are expected to be 24 percent higher than in 2011 but 11 percent lower than in 2000. The influence of quieter Stage 3 aircraft (which emit more NO_X and less VOCs than Stage 2 aircraft because of their higher combustion temperatures) and the forecast increase in aircraft operations at the Airport are reflected in these long-term results. Importantly, the current projections for 2030 do not incorporate technical innovations that are likely to be in effect at that time, including the introduction of Stage 4 engines, which will be cleaner and quieter. Therefore, with more operations and higher-emitting engines in the current database, the predicted NO_X emissions from aircraft are likely to be conservatively high.

Total emissions of CO in 2030 are expected to be 10 percent lower than in 2011 and 52 percent lower than in 2000. As with VOCs, CO emissions from aircraft would be largely a result of taxi/delay aircraft operations, thus, taxi times have a large influence on the CO aircraft emission estimates. Also, motor vehicle and GSE are expected to continue to become cleaner over time resulting in lower CO emissions.

Total emissions of $PM_{10}/PM_{2.5}$ in 2030 are expected to be 22 percent lower than 2005 levels and 3 percent lower than in 2011. This overall reduction since 2005 is primarily attributable to the nearly 100 percent decrease in the use of No. 6 fuel oil in favor of lower $PM_{10}/PM_{2.5}$-emitting natural gas and No. 6 fuel oil. However, the small decrease in emissions since 2011 is mostly due to the lower emissions from GSE in the future due to tighter emission controls for GSE.

Table 7-8 Emission Estimates for 2030 (in kg/day) at Logan Airport

	Projected Emissions			
Source Categories	**VOCs**	**NO_x**	**CO**	**$PM_{10}/PM_{2.5}$**
Aircraft Sources[1]				
Air carriers	382	4,262	2,752	38
Commuter aircraft	111	240	1,885	2
Cargo aircraft	20	226	134	2
General aviation	131	39	283	3
Total aircraft sources	644	4,767	5,054	45
Ground Service Equipment[2]	16	82	320	10
Motor Vehicles				
Parking/curbside	16	4	112	<1
On-airport vehicles	52	36	710	5
Total motor vehicle sources	68	40	822	6
Other Sources[3]				
Fuel storage/handling	399	0	0	0
Miscellaneous sources	4	179	56	4
Total other sources	403	179	56	4
Total Airport Sources	1,131	5,068	6,252	65

Source: Massport
Note: kg/day is approximately equivalent to 0.40234 tons per year (tpy).
1 Calculations for 2030 are based on taxi times based on the TAAM.
2 Includes vehicles and equipment converted to alternative fuels based on the 2011 fleet mix.
3 Includes the Central Heating and Cooling Plant, emergency electricity generation, and other stationary sources.

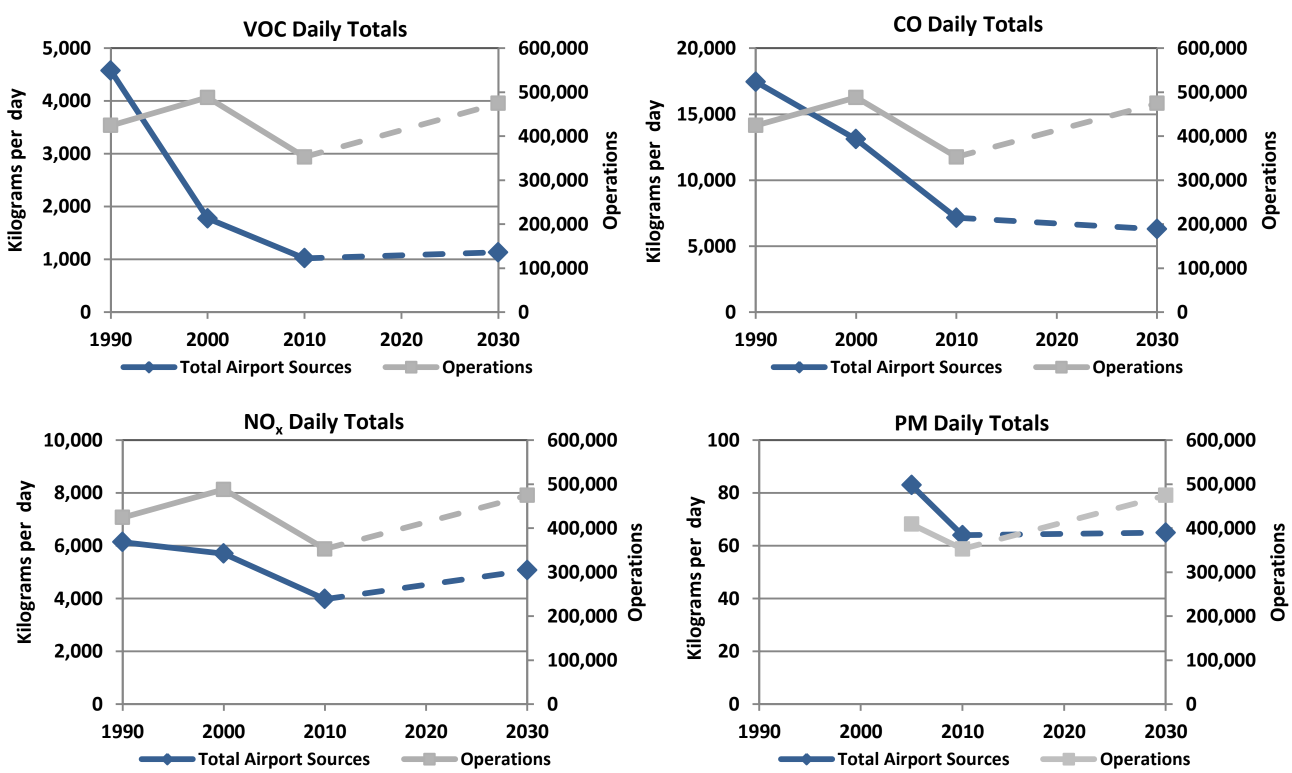
Again, the estimated emission totals for 2030 are expected to be measurably less for all pollutants than the values reported in this *2011 ESPR*. The current version of EDMS, which was used to calculate the 2030 emission inventory, does not reflect the significant design and operational improvements in aircraft engine technologies, alternative fuels, and aircraft operational measures, which will lead to lower fuel use, improved combustion efficiencies, and lower emissions.

Historical Context and Trends

This section provides a summary of the Logan Airport long-range emissions levels for VOCs, CO, NO_x, and $PM_{10}/PM_{2.5}$ from 1990 to the future year 2030. As shown, long-range emissions levels at Logan Airport have decreased since 1990 due to improvements in aircraft and motor vehicle engine combustion technologies and improvements to the Airport such as the Logan Airside Improvements Project. The emission trends for VOCs, NO_x, CO, and PM from 1990 to 2030 are shown in Figure 7-9 and operational levels at the Airport are also shown for comparative purposes.

Overall, there has been a long-range trend of decreasing emissions since 1990. However, from 2010 to 2030, the emissions of VOCs, NO_x, and PM are predicted to increase slightly. However, for no parameters are 2030 emissions predicted to be above historical highs (i.e., 1990) levels. This forecasted increase in emissions is mostly due to a corresponding increase in aircraft operations (352,643 in 2010 and 474,734 in 2030), fuel storage and handling, and stationary source fuel usage (e.g., boilers) predicted for the Airport over this same timeframe. By contrast, CO emissions continue to decrease through 2030 due to tighter emission controls for motor vehicles and GSE.

Figure 7-9 Long-Range Emissions Trends of VOCs, NO_X, CO, and PM at Logan Airport, 1990-2030[1]



Note: The dashed lines represent projected values.
1 PM emissions were not estimated until 2005.

Measured NO_2 Concentrations

This section presents the results of Massport's ambient (i.e., outdoor) air quality monitoring program for NO_2, a pollutant associated with aircraft activity and other fuel combustion sources. Between 1982 and early 2012, Massport collected NO_2 concentration data at numerous locations both on the Airport and in neighboring residential communities. The purpose of this monitoring program was to track long-term trends in NO_2 levels and to compare the results to the NAAQS for this pollutant. Massport determined that the Logan NO_2 Monitoring Program had achieved its objectives with the significant and stable decrease in NO_2 emissions since 1999. Massport discontinued the program in early 2012.

This monitoring program used passive diffusion tube technology for a period of one week each month for 12 months of the year at each of the monitoring stations (Figure 7-10). The samples of NO_2, along with Quality Assurance/Quality Control (QA/QC) samples, were then analyzed in a laboratory.

Table 7-9 presents the 2011 NO_2 monitoring data and Figure 7-10 depicts the locations of the 27 sites currently in the Massport NO_2 monitoring network. For comparative purposes, historical data from 1999 are also shown in Table 7-9. The table also includes NO_2 data collected under a separate effort by MassDEP using continuous monitors at four Boston-area locations (Figure 7-10).

As shown on Table 7-9, the 2011 NO_2 levels were generally higher than in 2010. This is consistent with the cyclical trend of the average levels over the past several years[15]. However, there remains a long-term trend of decreasing NO_2 concentrations at both the Massport and MassDEP monitoring sites since 1999. Other observations of the 2011 data show that:

- Annual NO_2 concentrations at all Massport and MassDEP monitoring locations were below the annual NO_2 NAAQS of 100 micrograms per cubic meter ($\mu g/m^3$) in 2011.
- The Massport-collected data compare relatively closely with data collected by the MassDEP. The average of all Massport monitoring sites was 29.8 $\mu g/m^3$ compared to 32.3 $\mu g/m^3$ for the four MassDEP Boston-area monitors.
- The highest NO_2 concentrations in 2011 from the Massport program occurred in areas characterized by high levels of motor vehicle traffic (i.e., Main Terminal Area [Site 8] and Maverick Square [Site 12]).

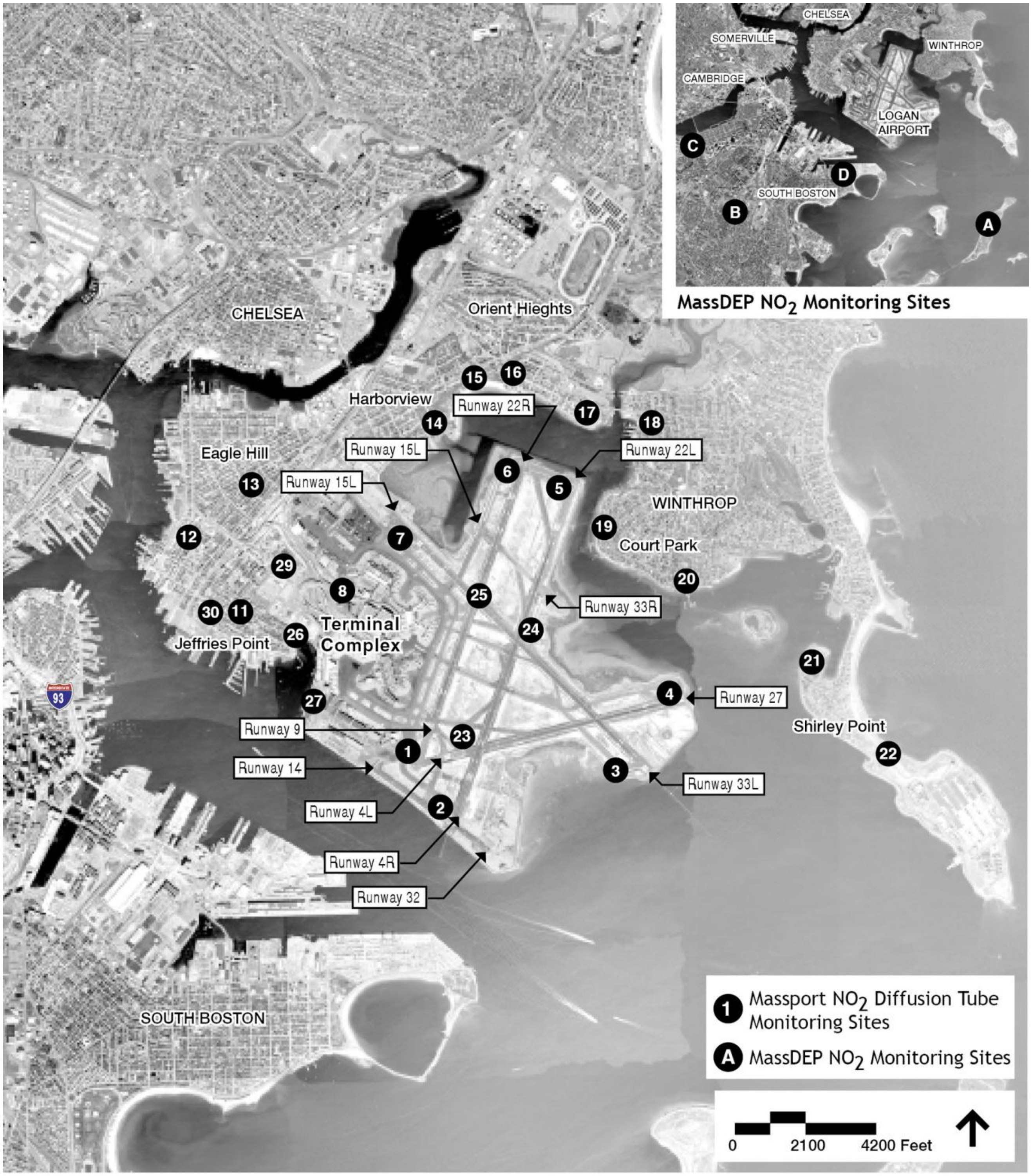
15 Spatial and temporal changes in measured NO_2 levels from year to year are typical and should not be used to define short-term results. Rather, NO_2 levels are better assessed by looking at the trends over several years.

Table 7-9 Massport and MassDEP Annual NO_2 Concentration Monitoring Results ($\mu g/m^3$)

Monitoring Site	Site No.	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Massport Monitoring Sites														
Runway 9	**1**	61.0	58.2	41.6	45.8	33.9	30.1	35.0	31.9	17.3	31.3	32.2	32.3	38.7
Runway 4R	**2**	55.6	44.6	41.4	36.9	32.5	30.9	30.7	29.0	17.2	20.2	19.2	21.9	25.7
Runway 33L	**3**	47.7	42.6	39.4	33.3	30.8	25.4	24.5	26.3	24.2	21.6	16.9	25.0	29.8
Runway 27	**4**	42.9	37.8	35.8	30.3	25.5	24.1	22.7	22.3	16.9	18.3	17.6	19.4	23.3
Runaway 22L	**5**	47.5	39.8	38.2	33.8	27.8	23.7	22.1	24.9	17.1	21.3	20.1	21.9	29.0
Runway 22R	**6**	60.6	59.2	51.6	45.0	32.3	29.7	32.9	25.1	24.8	29.7	27.8	33.1	30.6
Runway 15R	**7**	47.0	43.4	44.3	42.6	40.8	28.7	27.7	28.7	20.5	24.2	23.9	26.7	29.7
Main Terminal Area	**8**	70.8	87.0	80.7	69.3	44.3	44.7	46.2	43.5	29.5	41.7	37.7	43.9	49.0
Webster St., Jeffries Point	**11**	52.4	45.5	43.4	39.1	32.5	28.3	31.3	31.3	22.7	25.2	23.9	27.0	30.1
Maverick Square, E. Boston	**12**	81.2	72.2	68.5	61.3	47.9	46.5	41.4	45.6	36.0	41.3	38.2	42.5	43.5
Bremen St., E. Boston	**13**	59.1	52.6	52.0	46.2	39.1	35.7	37.6	37.1	27.8	30.1	28.6	31.9	35.3
Shore St. E. Boston	**14**	45.7	38.5	38.8	35.0	27.2	24.0	24.9	22.4	18.1	19.7	18.3	20.7	26.7
Orient Heights Yacht Club	**15**	45.1	46.9	47.7	43.1	29.4	25.2	25.5	25.1	19.6	21.1	18.3	22.5	26.7
Bayswater St. E. Boston	**16**	45.2	45.5	48.3	41.2	28.4	22.8	30.4	23.1	18.4	20.2	17.8	21.0	25.9
Annavoy St. E. Boston	**17**	40.8	39.2	44.4	33.7	24.7	21.4	23.3	21.0	18.2	19.6	17.3	20.9	25.8
Pleasant St. Winthrop	**18**	42.0	39.3	37.8	32.3	27.9	22.6	23.4	21.4	17.8	20.2	17.7	20.1	24.4
Court Road, Winthrop	**19**	40.0	36.1	33.8	27.4	24.0	19.2	22.3	21.0	16.3	17.1	16.7	18.4	22.7
Cottage Park Yacht Club	**20**	37.1	50.9	45.9	36.7	22.5	19.1	27.7	21.4	16.3	18.4	17.8	17.8	22.5
Winthrop, Point Shirley	**21**	33.1	37.7	38.6	24.4	22.7	17.4	17.2	20.2	15.7	15.6	14.9	17.5	21.6
Deer Island	**22**	36.3	31.9	33.8	33.1	21.3	17.8	16.9	17.8	13.0	17.0	14.7	16.7	20.7
Runway 4R–9	**23**	42.2	66.0	42.3	33.4	28.6	24.1	27.1	26.3	19.2	22.4	21.2	21.6	26.5
Runway 33L–4R	**24**	44.3	41.7	41.8	33.5	28.1	24.3	22.3	25.7	20.9	25.2	20.0	23.6	26.2
Runway 22R–33L	**25**	62.4	50.3	49.4	42.2	33.8	31.7	29.4	34.5	22.9	25.1	25.3	29.5	34.9
Jeffries Point Park/Marginal St.	**26**	68.6	49.8	45.0	42.0	35.2	30.5	32.5	31.7	24.4	27.0	25.6	28.6	33.1
Harborwalk	**27**	54.3	48.5	47.4	43.5	35.6	35.5	29.3	34.2	24.2	26.1	24.5	28.3	34.9
Logan Athletic Fields	**29**	NA	69.1	67.6	54.9	41.9	40.2	37.5	37.0	24.6	28.8	26.8	30.8	37.8
Brophy Park, Jeffries Point	**30**	NA	48.0	45.2	41.0	36.5	31.2	32.9	31.3	24.8	26.6	24.6	26.8	30.8
Average of all Monitoring Sites		**50.5**	**50.5**	**47.5**	**40.0**	**31.7**	**28.0**	**28.7**	**28.7**	**21.0**	**24.3**	**22.5**	**25.6**	**29.8**
MassDEP Monitoring Sites[1]														
Long Island Rd (MassDEP)	**A**	20.7	24.4	22.6	22.6	16.9	12.6	13.2	13.2	13.2	13.2	11.3	13.6	13.4
Harrison Ave. (MassDEP)	**B**	NA	45.1	47.0	45.1	43.2	37.4	35.8	35.8	37.7	37.7	33.9	32.1	33.1
Kenmore Square (MassDEP)	**C**	56.4	54.5	56.8	47.0	47.0	51.7	43.3	43.3	39.6	41.5	37.7	36.0	38.4
East First Street (MassDEP)	**D**	39.5	37.6	43.2	39.5	39.5	36.8	33.9	39.6	37.7	30.2	28.3	24.0	25.4

Source: Massport
Notes: The NAAQS is 100 $\mu g/m^3$. The site identification labels in Figure 7-10 are keyed to the site labels in this table.
$\mu g/m^3$ micrograms/cubic meter.
NA Not available.
1 NO_2 monitoring sites operated by the MassDEP.

Figure 7-10 Massport NO_2 Monitoring Sites



Greenhouse Gas (GHG) Assessment

There is now widespread consensus that GHGs contribute to climate change (also known as global warming), although there is still some uncertainty regarding the global magnitude of this impact and the associated short- and long-term remedies. In April 2009, the EPA issued a proposed finding that GHGs contribute to air pollution that may endanger public health or welfare. This action has laid the initial groundwork for the regulation of GHG emissions nation-wide under the CAA, although currently there are no specific U.S. laws or regulations that call for the regulation of GHGs associated with airports. The climate change bills proposed in Congress have thus far focused on entities that emit significant amounts of GHGs and those that have direct control over these emissions (i.e., power plants, fuel producers, cement manufacturing, etc.). Current estimates of aviation-related GHG emission contributions to man-made totals range from 2 to 4 percent world-wide and approximately 3 percent nationwide.[16,17]

In May 2010, the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) revised the *Massachusetts Environmental Policy Act (MEPA) Greenhouse Gas Emissions Policy and Protocol*.[18] Under the revised policy, certain projects undergoing review under MEPA (not specifically this *2011 ESPR*) are required to:

- Quantify the GHG emissions generated by proposed projects
- Identify measures to avoid, minimize, or mitigate such emissions[19]

Although Massport-related emissions represent only 12 percent of total GHG emissions at the Airport, Massport has voluntarily set goals and developed plans to reduce and offset GHGs associated with Logan Airport to further minimize the "carbon footprint" of Massport facilities. These initiatives include (but are not limited to) the implementation of carbon-based energy saving programs, purchase of renewable energy credits, and other capital investments that will conserve fossil fuel and energy in both the short- and long-term. In conjunction with the Massachusetts Global Warming Solutions Act, Massport has participated in working groups primarily focused on reducing transportation and building energy demand by increasing energy efficiency, providing incentives to increase passengers per vehicle, and expanding upon opportunities for alternative (low-emitting) fuel use within the transportation sector.

Since October 2009, Massport has also been part of the Commonwealth's Climate Adaptation Advisory Committee. Within this committee, the Key Infrastructure team looked at potential issues at airports related to service disruption, access issues, flooding, and other storm-related impacts. The final Climate Change Adaptation Report was issued in September 2011.

With respect to the GHG emissions inventory conducted for 2011, the following information is noteworthy:

- Even though the *2011 ESPR* is not subject to the MEPA GHG policy since it does not propose any discrete projects, Massport has voluntarily prepared an inventory of GHG emissions directly and indirectly associated with the Airport starting with the *2007 EDR*. The results from the 2007 and 2008 GHG inventories are not presented in this chapter because these inventories were calculated before the ACRP-based methodology was available. GHG inventories from 2009 through 2011 are based on the ACRP methodology.

16 Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, New York City, NY. 2007.
17 U.S. Governmental Accountability Office (GAO), Aviation and the Environment, NextGen and Research and Development Are Keys to Reducing Emissions and Their Impact on Health and Climate, May 6, 2008.
18 Revised *MEPA Greenhouse Gas Emissions Policy and Protocol*, Massachusetts Executive Office of Energy and Environmental Affairs, effective May 5, 2010.
19 These GHG are comprised primarily of carbon dioxide (CO_2), methane (CH_4), nitrous oxides (N_2O), and three groups of fluorinated gases (i.e., sulfur hexafluoride [SF_6], hydrofluorocarbons [HFCs], and perfluorocarbons [PFCs]). GHG emission sources associated with airports are generally limited to CO_2, CH_4, and N_2O.

- For this assessment, the 2011 and 2030 GHG emissions inventories include aircraft operations within the ground-based taxi-idle/delay mode, up to the top of the 3,000–foot LTO cycle). GHG emissions associated with GSE/APU, motor vehicles, a variety of stationary sources, and electricity usage were also included.
- Massport has direct ownership or control over a small percentage of these GHG emission sources (i.e., limited to Massport fleet vehicles, stationary sources, and electrical consumption within Massport buildings). The vast majority of the emission sources are owned or controlled by the airlines, other airport tenants (such as rental car companies), and the general public (such as passenger motor vehicles).
- Massport also prepares two other GHG emissions inventories for Logan Airport:
  - A 2011 GHG emissions inventory for the MassDEP GHG Emissions Reporting Program for those sources meeting the criteria for Category 1 and Scope 1 (i.e., only those sources under the direct ownership and control of Massport)[20]
  - EPA Greenhouse Gas Summary Report[21]

This analysis followed the EOEEA guidelines and uses widely-accepted emission factors that are considered appropriate for airports, including International Organization for Standardization (ISO) New England electricity-based values. The analysis of GHG emissions below presented is also consistent with the ACRP guidance with the exception that only a portion of aircraft cruise mode emissions (below 3,000-foot LTO cycle) were included.

For the *2011 ESPR*, GHG emissions are categorized by ownership and control including: (1) emissions related to Massport activities were assigned to the Massport category; (2) emissions related to airport tenants were assigned to the tenant category; and (3) emissions related to the public, such as private automobiles, were assigned to the public category. These three categories (identified in Table 7-10) are also characterized by the degree of control that the airport operator (Massport) has over GHG emissions.

- Category 1 – GHG emissions from sources that are owned and controlled by the reporting entity (e.g., Massport). Category 1 typically represents sources which are owned by the entity - or sources which are not owned by the entity, but over which the entity can exert control. At Logan Airport, these sources include airport-owned and controlled stationary sources (e.g., boilers, generators, etc.), fleet vehicles, and purchased electricity. On-airport ground transportation and off-airport employee vehicle trips are included as Category 1 emissions as they are partly controlled by the airport.
- Category 2 – This category comprises sources owned and controlled by airlines and airport tenants, and include aircraft (on-ground, within the LTO up to 3,000 feet, GSE/APU, electrical consumption, and employee vehicles.

Category 3 – This category generally comprises GHG emissions associated with passenger ground access vehicles. These include public automobiles, taxis, limousines, buses, shuttle vans, etc. operating on the off-airport roadway network.

Consistent with the ACRP guidance, once the ownership categories are determined, the operational boundaries are also set, reflecting the Scope of the emission source (refer to Table 7-10) and include:

20 Boston Logan International Airport, Massachusetts Department of Environmental Protection GHG Emissions Reporting Program, April 17, 2012.
21 U.S. EPA Greenhouse Gas Summary Report for Boston Logan International Airport, June 14, 2012.

- Scope 1 / Direct – GHG emissions from sources that are owned and controlled by the reporting entity (e.g., Massport) such as stationary sources and airport-owned fleet motor vehicles.
- Scope 2 / Indirect – GHG emissions associated with the generation of electricity consumed, but generated off-site at public utilities.
- Scope 3 / Indirect and Optional – GHG emissions that are associated with the activities of the reporting entity (e.g., Massport), but are associated with sources that are owned and controlled by others. These include aircraft-related emissions, emissions from airport tenant's activities, as well as ground transportation to and from the Airport.

Table 7-10 Ownership Categorization and Emissions Category/Scope

Owning/Controlling Entity Categories	Source	Category/Scope
Massport Owned and/or Controlled	Massport Fleet Vehicle	Category 1/Scope 1
	On-airport Ground Transportation	Category 1/Scope 1
	Off-airport Employee Vehicle Trips	Category 1/Scope 3
	On-airport Parking Lots	Category 1/Scope 1
	Stationary Sources (includes generators, boilers, etc.)	Category 1/Scope 1
	Fire Training	Category 1/Scope 1
	Electrical Consumption	Category 1/Scope 2
Tenant Owned and/or Controlled (includes airlines, government, concessionaires, aircraft operators, fixed-based operators, etc.)	Aircraft (on-ground, within the LTO up to 3,000 feet)	Category 2/Scope 3
	Auxiliary Power Units	Category 2/Scope 3
	Ground Support Equipment	Category 2/Scope 3
	Off-airport Employee Vehicle Trips	Category 2/Scope 3
	Electrical Consumption	Category 2/Scope 2
Public Owned and Controlled	Off-airport Vehicle Trips (Includes private automobiles, taxis, limousines, buses, shuttle vans, etc., operating on the off-airport roadway network)	Category 3/Scope 3

Source: Massport
Note: Follows Airport Cooperative Research Program (ACRP) guidance.
LTO Landing and Takeoff

The GHG emissions inventory included in this *2011 ESPR* is consistent with the data provided in MassDEP and EPA GHG inventories. However, the *2011 ESPR* GHG emissions inventory is more comprehensive as it covers all three scopes of GHG emissions at Logan Airport including those from tenants and the public, which is consistent with ACRP guidance.[22] Additionally, the EPA GHG Reporting Program covers only stationary sources (Category 1 and Scope 1).

Table 7-11 presents the 2011 GHG emissions inventory reported in CO_2 equivalent values.[23] Massport-related emissions represent only 12 percent of total GHG emissions at the Airport. Tenant-based emissions represent 68 percent, electrical consumption from Massport, common areas, and tenants represents 14 percent, and passenger vehicle emissions represent 6 percent of total GHG emissions. Aircraft represents the largest source of emissions followed by motor vehicles and electricity generation. When segregated by Scopes, as shown in Figure 7-11, tenants and passenger vehicles (Scope 3) represent the largest source of GHG emissions at 74 percent, followed by electrical consumption (Scope 2) at 14 percent, and Massport (Scope 1) at 12 percent.

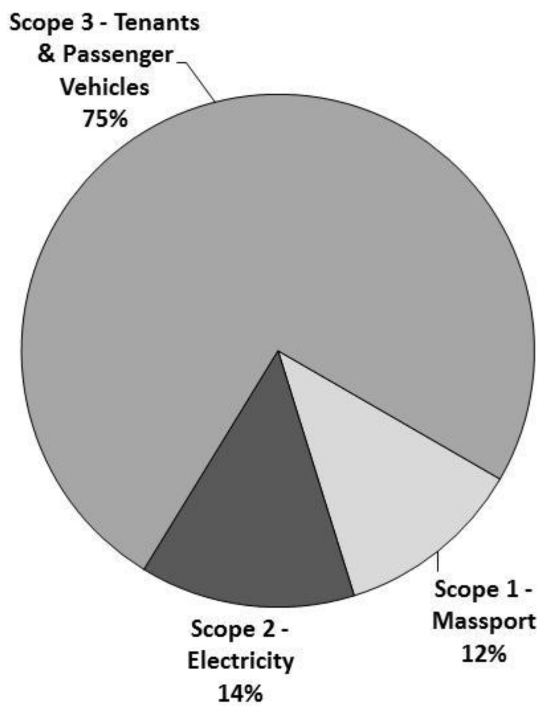
22 However, aircraft cruise mode emissions above the 3,000-foot LTO cycle were not included.
23 CO_2 equivalent values are based upon the Global Warming Potential values of 1 for CO_2, 25 for CH_4, and 298 for N_2O (based on a 100 year period) as presented in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, *2007.*

Table 7-11 Estimated Greenhouse Gas Emissions Inventory (in MMT of CO_2eq) at Logan Airport, 2011[1]

Source	Category	Scope	CO_2	N_2O	CH_4	Totals
Massport Emissions						
Ground Support Vehicles[2]	1	1	0.01	<0.01	<0.01	0.01
Massport Shuttle Bus	1	1	<0.01	<0.01	<0.01	<0.01
Massport Express Bus	1	1	<0.01	<0.01	<0.01	<0.01
On-Airport Roadways[3]	1	1	0.02	<0.01	<0.01	0.02
Off-Airport Roadways (Employees)[4]	1	3	<0.01	<0.01	<0.01	<0.01
Parking Lots	1	1	<0.01	<0.01	<0.01	<0.01
Stationary Sources[5]	1	1	0.03	<0.01	<0.01	0.03
Total Massport Emissions (12.0%)			**0.07**	**<0.01**	**<0.01**	**0.07**
Tenant Emissions						
Aircraft – Ground[6]	2	3	0.19	<0.01	<0.01	0.19
Aircraft – Ground to 3000 feet[7]	2	3	0.17	<0.01	<0.01	0.17
Aircraft Engine Startup	2	3	<0.01	<0.01	<0.01	<0.01
Ground Support Equipment	2	3	0.01	<0.01	<0.01	0.01
Auxiliary Power Units	2	3	0.01	<0.01	<0.01	0.01
Off-Airport Roadways (Employees)[4]	2	3	0.02	<0.01	<0.01	0.02
Total Tenant Emissions (67.8%)			**0.39**	**<0.01**	**<0.01**	**0.40**
Purchased Electricity Emissions[8]						
Massport	1	2	0.01	<0.01	<0.01	0.01
Tenant	2	2	0.03	<0.01	<0.01	0.03
Common Area	3	2	0.05	<0.01	<0.01	0.05
Total Purchased Electricity Emissions (14.0%)			**0.08**	**<0.01**	**<0.01**	**0.08**
Passenger Vehicle Emissions						
Off-Airport Roadways[4]	3	3	0.04	<0.01	<0.01	0.04
Total Passenger Vehicle Emissions (6.2%)			**0.04**	**<0.01**	**<0.01**	**0.04**
Total Logan Airport Emissions[9]			**0.58**	**<0.01**	**<0.01**	**0.58**
Percent of Statewide Totals[10]			<1.0%	<1.0%	<1.0%	<1.0%

Source: Massport
1 MMT - million metric tons of CO_2 equivalents (1 MMT = 1.1M Short Tons). CO_2 equivalents (CO_2eq) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O, and CH_4) in common units. Quantities are reported as "rounded" and truncated values for ease of addition.
2 Ground Support Vehicles include the Logan Airport fleet. Emissions were calculated based on fuel usage.
3 On-airport roadways based on on-site vehicle miles traveled (VMT) and includes all vehicles.
4 Off-site roadways based on off-site Airport-related VMT and an average round trip distance of 60.5 miles (2010 Passenger Ground Access Survey).
5 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters, and live fire training facility.
6 Aircraft – Ground emissions include taxi-in, taxi-out and ground-based delay emissions.
7 Aircraft – Ground to 3,000 feet include takeoff, climbout, and approach emissions up to a height of 3,000 feet (as specified by the ACRP guidance).
8 Emissions from electrical consumption occurs off-airport at power generating plants.
9 Total Emissions = Airport + Tenant + Public.
10 Percentage based on relative amount of total emissions to statewide total from World Resources Institute (cait.wri.org).

Figure 7-11 Sources of GHG Emissions, 2011



Note: Scope 1 emissions are from sources that are owned or controlled by Massport, Scope 2 emissions are from electrical consumption, which are generated off-Airport at power generating plants, and Scope 3 emissions are from airport tenants and ground transportation to and from the Airport.

In summary, total 2011 GHG emissions were slightly higher (5 percent) than 2010 levels due partly to a 5 percent increase in aircraft operations and passenger automobile traffic. Massport plans to annually update and report on the GHG Emissions Inventory for Logan Airport through the EDR/ESPR.

As with the 2011 analysis, the 2030 GHG emission inventory is also based on guidance developed by TRB's ACRP to compute GHG emissions.[24] Thus, the 2030 inventory also assigns emissions based on ownership or control (e.g., Massport, airlines and other airport tenants, and the general public). The vast majority of emission sources at Logan Airport are controlled by the airlines, airport tenants, (through emissions from aircraft and GSE) and the general public (through emissions from motor vehicles). The 2030 Massport-related emissions are expected to represent only 11 percent of total GHG emissions at the Airport. Tenant-based emissions represent 72 percent, electrical consumption from Massport, common areas, and tenants represents 13 percent, and passenger vehicle emissions represent 4 percent of total GHG emissions. Table 7-12 presents the predicted 2030 GHG emissions inventory reported in CO_2 equivalent values.

This expected increase in operations is partially offset by greater motor vehicle and GSE fuel efficiencies (associated with advancements in equipment technology on a nation-wide basis and regulatory requirements). Additionally, actions are underway within the U.S. and by other nations to reduce aviation's contribution through such measures as new aircraft technologies to reduce emissions and improve fuel efficiency, renewable alternative fuels with lower carbon footprints, more efficient air traffic management, market-based measures and environmental regulations including an aircraft CO_2 standard.

24 Transportation Research Board, Airport Cooperative Research Program, ACRP Report 11, Project 02-06, *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories*. See http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_011.pdf for the full report.

As shown in Figure 7-12, in 2030 tenants and passenger vehicles (Scope 3) represent the largest source of GHG emissions at 76 percent, followed by electrical consumption (Scope 2) at 13 percent, and Massport (Scope 1) at 11 percent.

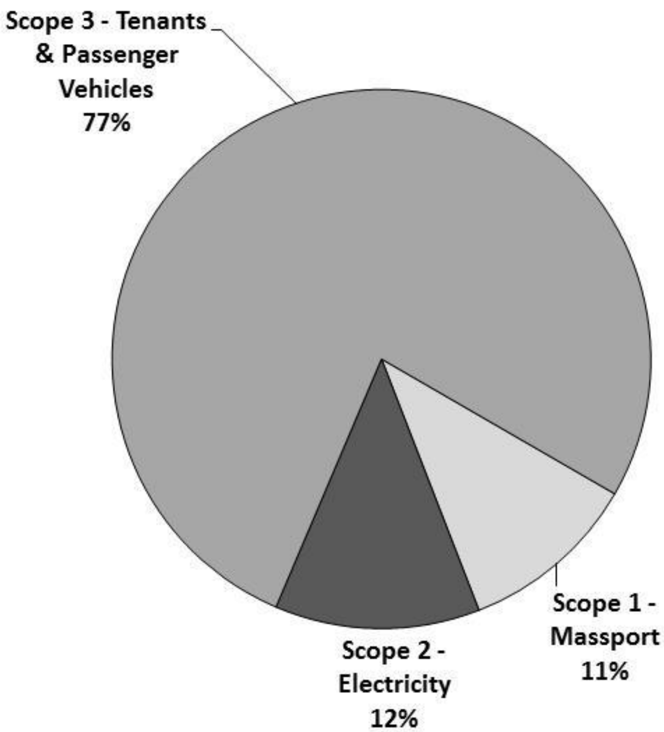
Table 7-12 Estimated Greenhouse Gas Emissions Inventory (in MMT of CO_2eq) at Logan Airport, 2030[1]

Source	Category	Scope	CO_2	N_2O	CH_4	Totals
Massport Emissions						
Ground Support Vehicles[2]	1	1	0.01	<0.01	<0.01	0.01
Massport Shuttle Bus	1	1	<0.01	<0.01	<0.01	<0.01
Massport Express Bus	1	1	<0.01	<0.01	<0.01	<0.01
On-Airport Roadways[3]	1	1	0.02	<0.01	<0.01	0.02
Off-Airport Roadways (Employees)[4]	1	3	<0.01	<0.01	<0.01	<0.01
Parking Lots	1	1	<0.01	<0.01	<0.01	<0.01
Stationary Sources[5]	1	1	0.03	<0.01	<0.01	0.03
Total Massport Emissions (10.5%)			**0.07**	**<0.01**	**<0.01**	**0.07**
Tenant Emissions						
Aircraft – Ground[6]	2	3	0.20	<0.01	<0.01	0.20
Aircraft - Ground to 3000 feet[7]	2	3	0.23	<0.01	<0.01	0.23
Aircraft Engine Startup	2	3	<0.01	<0.01	<0.01	<0.01
Ground Support Equipment	2	3	0.01	<0.01	<0.01	0.01
Auxiliary Power Units	2	3	0.01	<0.01	<0.01	0.01
Off-Airport Roadways (Employees)[4]	2	3	0.01	<0.01	<0.01	0.01
Total Tenant Emissions (72.5%)			**0.47**	**<0.01**	**<0.01**	**0.47**
Purchased Electricity[8] Emissions						
Massport	1	2	0.01	<0.01	<0.01	0.01
Tenant	2	2	0.03	<0.01	<0.01	0.03
Common Area	3	2	0.05	<0.01	<0.01	0.05
Total Purchased Electricity Emissions (13.0%)			**0.08**	**<0.01**	**<0.01**	**0.08**
Passenger Vehicle Emissions						
Off-Airport Roadways[4]	3	3	0.03	<0.01	<0.01	0.03
Total Passenger Vehicle Emissions (4.0%)			**0.03**	**<0.01**	**<0.01**	**0.03**
Total Logan Airport Emissions			**0.65**	**<0.01**	**<0.01**	**0.65**

Source: Massport

1 MMT - million metric tons of CO_2 equivalents (1 MMT = 1.1M Short Tons). CO_2 equivalents (CO_2eq) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O, and CH_4) in common units. Quantities are reported as "rounded" and truncated values for ease of addition.
2 Ground Support Vehicles include the Logan Airport fleet. Emissions were calculated based on fuel usage.
3 On-airport roadways based on on-site vehicle miles traveled (VMT) and includes all vehicles.
4 Off-site roadways based on off-site Airport-related VMT and an average round trip distance of 60.5 miles (2010 Passenger Ground Access Survey).
5 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters, and live fire training facility.
6 Aircraft – Ground emissions include taxi-in, taxi-out and ground-based delay emissions.
7 Aircraft – Ground to 3,000 feet include takeoff, climbout, and approach emissions up to a height of 3,000 feet (as specified by the ACRP guidance).
8 Emissions from electrical consumption occurs off-airport at power generating plants.
9 Total Emissions = Airport + Tenant + Public.

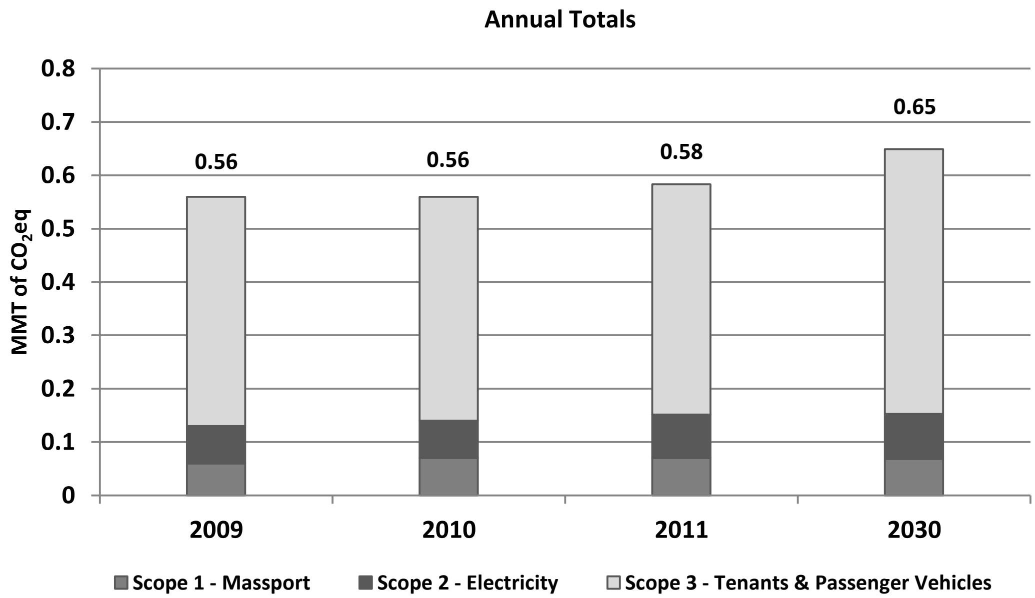
Figure 7-12 Sources of GHG Emissions, 2030



Note: Scope 1 emissions are from sources that are owned or controlled by Massport, Scope 2 emissions are from electrical consumption, which are generated off-Airport at power generating plants, and Scope 3 emissions are from airport tenants and ground transportation to and from the airport.

As shown in Figure 7-13, total GHG emissions in 2030 are estimated to be 11 percent higher than 2011 levels because of the forecasted 29 percent increase in aircraft operations and 38 percent increase in traffic, which result in increased fuel usage and VMT. The increase in total GHG emissions is due to the increase in Scope 3 emissions (tenants and passenger vehicles). Scope 1 (Massport) is predicted to remain constant through 2030 due to tighter emission controls for motor vehicles. Scope 2 (electricity) is predicted to increase slightly by 3 percent due to the Terminal B project (increased terminal area for the Terminal C-E connector).

Figure 7-13 Emissions of GHG at Logan Airport



Air Quality Emissions Reduction

As part of implementing the ongoing Logan Airport Air Quality Management Plan, Massport has established a number of goals and objectives to address air emissions from Airport operations, including the minimization of Airport-related emissions through the AQI and the reduction of GSE and Massport fleet emissions with AFV. This section presents an update on the AQI and the AFV Program at Logan Airport.

Air Quality Initiative

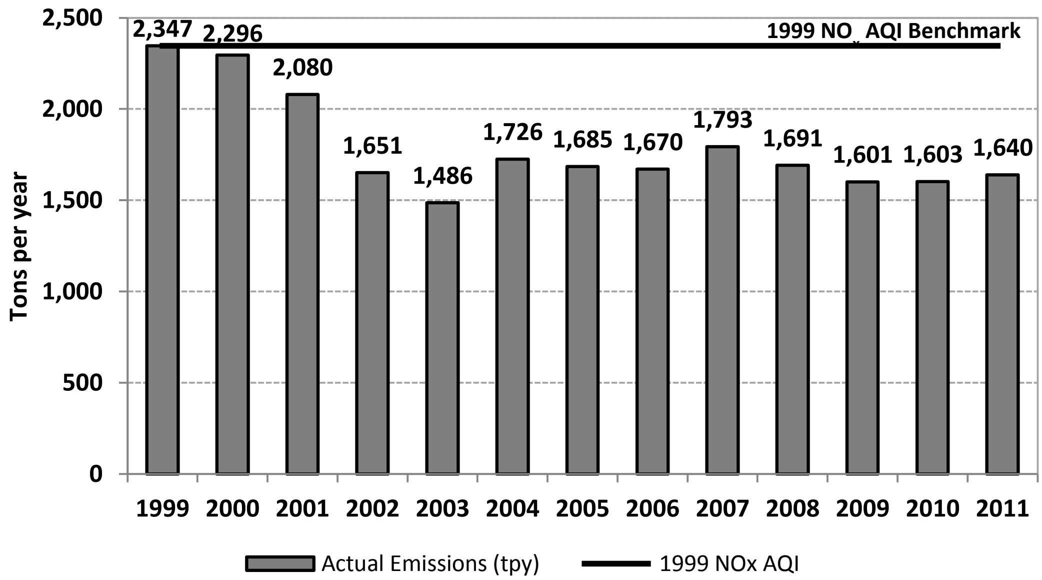
Massport developed the AQI as a 15-year voluntary program with the overall goal to maintain NO_x emissions associated with Logan Airport at, or below, 1999 levels. The AQI has four primary commitments, shown below, along with Massport's progress in meeting the AQI commitments.

- **Expand on the initiatives already in-place at Logan Airport.** See Table 7-13 for the initiatives in place at the time the AQI was developed.
- **As necessary to maintain NO_x emissions at or below 1999 levels, retire emissions credits, giving priority to mobile sources.** Massport updates the Logan Airport inventory of NO_x emissions annually to reflect new information and changing conditions associated with the Airport's operations. Table 7-13 presents the updated emissions inventory and shows that, in 2011, it was not necessary to purchase and retire mobile source emission credits to maintain NO_x emissions at or below 1999 levels.
- **Report the status and progress of the AQI in the ESPR or EDR.** Massport reports on the status of the AQI in the Logan Airport EDRs and ESPRs and has done so since 2001 (Table 7-13).
- **Continue to work at international and national levels to decrease air emissions from aviation sources.** Massport maintains memberships and active participation in a number of organizations involved in addressing aviation-related environmental issues, including air quality. These include serving on technical review committees of the Airports Council International (ACI) and American Association of Airport Executives (AAAE).

As shown in Table 7-13, NO_x emissions at Logan Airport in 2011 were 707 tpy lower than the 1999 AQI benchmark. This represents a 30 percent decrease since 1999. Between 1999 and 2011, the greatest reductions of NO_x emissions were associated with aircraft, GSE, and on-Airport motor vehicles with reductions of 23 percent, 61 percent, and 69 percent reductions, respectively.

Figure 7-14 compares the 1999 benchmark threshold level of 2,347 tpy of NO_X emissions to estimated NO_x emissions for 2001 through 2011. Cumulatively, as of December 31, 2011, NO_x emissions at Logan Airport were approximately 7,267 tons below the benchmark set by the AQI. As shown in Table 7-13, based upon current projections, Massport expects that because the emission inventory is projected to be well below the 1999 threshold of 2,347 tpy through 2015, no credits will need to be purchased through the AQI period ending in 2015. Although NO_x emissions are predicted to increase from 2011 to 2030, NO_x emissions in 2030 will still remain well below (15 percent) this 1999 benchmark.

Figure 7-14 NO_X Emissions Compared to AQI[1]



As part of the reporting process, the AQI calls for an itemization of NO_x emissions generated by activities at Logan Airport according to the individual airline operator. Table 7-13 shows the estimated amounts of NO_x air emissions generated by each airline in units of tpy and Table 7-14 shows NO^x in tons per LTO.

Based on Table 7-14, international carriers are the higher NO_x emitters per LTO because their longer stage lengths require aircraft equipped with larger and/or additional engines and heaver takeoff weight (more fuel). Overall, international carriers emit 15.0 percent of the total aircraft NO_x emissions at Logan Airport. Other findings include:

- Carriers with the greatest number of flights tended to generate the highest percentage of total NO_x emissions;
- Combined, the four largest air carriers (by LTO), emitted 52.6 percent of the total aircraft NO_x emissions;
- Commercial airlines (excludes cargo and GA) accounted for 93.1 percent of total aircraft NO_x emissions;
- Cargo aircraft operators accounted for 5.7 percent of total aircraft NO_x emissions; and
- GA aircraft accounted for 1.2 percent of total aircraft NO_x emissions.

Table 7-13 AQI Inventory Tracking of NO_X Emissions (in tpy)[1] for Logan Airport

	Actual Conditions[2]													Forecasted Conditions[3]			
	1999[4]	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Annual Emissions	2,347[5]	2,315	2,097	1,665	1,499	1,745	1,703	1,688	1,806	1,701	1,609	1,608	1,647	1,676	1,697	1,719	1,740
Above (Below) 1999 Levels Before Reductions	NA	(32)	(250)	(682)	(848)	(602)	(644)	(659)	(541)	(646)	(738)	(739)	(700)	(671)	(650)	(628)	(607)
Potential Reductions/ Increases[6]																	
Alternative Fuel Vehicles/Shuttle Bus	(11)	(4)	(4)	(3)	(3)	(10)	(9)	(8)	(7)	(5)	(4)	(2)	(1)	(2)	(1)	0	1
Alternate Fuel Ground Service Equipment[7]	(14)	(14)	(13)	(11)	(10)	(9)	(9)	(10)	(6)	(5)	(4)	(3)	(6)	(10)	(11)	(11)	(11)
Total Potential Reductions	(25)	(19)	(17)	(14)	(13)	(19)	(18)	(18)	(13)	(10)	(8)	(5)	(7)	(13)	(12)	(11)	(10)
Above (Below) 1999 Levels After Reduction	(25)	(51)	(267)	(696)	(861)	(621)	(662)	(677)	(554)	(656)	(746)	(744)	(707)	(684)	(662)	(639)	(617)
Credit Trading[8]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Net Total w/Reductions and Credits	2,322	2,296	2,080	1,651	1,486	1,726	1,685	1,670	1,793	1,691	1,601	1,603	1,640	1,663	1,685	1,708	1,730

Source: Massport

Notes: Values in parentheses, such as "(250)" are negative values. Values without parentheses are positive values.

NA Not available.

1 For consistency with the AQI, the NOx emission values in this table are reported in tpy. The EDR/ESPR Emissions Inventory values are reported in kg/day. A conversion factor of 0.40234 is used to convert kg/day to tpy.

2 1999 and 2004 analysis years were updated in the 2004 ESPR using EDMS v4.21. The 2000 and 2001 analyses were completed using EDMS v4.03 and MOBILE6. The 2002 to 2003 analyses were completed using EDMS v4.11 and MOBILE6. The 2004 analysis was completed using EDMS v4.21 and MOBILE6.2.01. The 2005 analysis was completed using EDMS v4.5 and MOBILE6.2.03. The 2006 analysis was completed using EDMS v5.0.1 and MOBILE6.2.03. The 2007 analysis was completed using EDMS v5.0.2 and MOBILE6.2.03. The 2008 analysis was completed using EDMS v5.1 and MOBILE6.2.03. The 2009 analysis was completed using EDMS v5.1.2 and MOBILE6.2.03. The 2010 and 2011 analysis was completed using EDMS v5.1.3 and MOBILE6.2.03.

3 The years 2012 through 2015 were interpolated using the 2030 analysis provided in Table 7-8 of the *2011 ESPR*. These emission estimates will be updated in the next ESPR based on up-to-date operational forecasts for the Airport.

4 The year 1999 is the "baseline" year for the AQI. Thus, 2,347 tons/year is considered the AQI threshold for NOx emissions.

5 The original value of 2,235 tons/year in the AQI was based on the 2001 EDR results and EDMS v4.03. This value was updated in the 2004 ESPR using EDMS v4.21.

6 Other initiatives that Massport and Logan Airport tenants may use for possible emission reductions include: Consolidated Car Rental Facility (ConRAC), Central Heating and Cooling Plant boilers, 400-Hz power at gates, and low NOx fuels in Logan Express buses.

7 Massport's current plan for the conversion of GSE to alternative fuels is being re-evaluated based on the new diesel rule (2007). GSE AFV credits were based on fuel type data obtained from the aerodrome vehicle permit applications beginning in 2007.

8 Since the AQI threshold is not exceeded in 2011, nor are the emissions expected to exceed the threshold in the near future, no credits will need to be purchased in the immediate term.

Table 7-14 Contribution of NO_X Air Emissions by Airline, 2011 (Estimated)

	Total Emissions (tons/year)		Normalized Emissions (tons/LTO)
Air Carrier, by Airline	LTOs	NO_x	NO_x per LTO
ACM Aviation	20	0.04	0.002
Aer Lingus	565	16.95	0.030
Aeromexico	16	0.17	0.011
Air Canada[1]	5,483	15.54	0.003
Air France	506	22.62	0.045
Air Transport	33	0.63	0.019
Airnet	369	0.02	<0.001
Airtran Airways	6,435	50.75	0.008
Alaska Airlines	878	11.04	0.013
Alitalia	302	8.24	0.027
Allegiant Air	65	0.56	0.009
American Airlines[2]	14,983	158.99	0.011
Astraeus	50	0.49	0.010
Atlantic Southeast	2,544	8.66	0.003
Bombardier Business Jet	431	0.56	0.001
British Airways	1,081	65.58	0.061
Capital Cargo	113	1.00	0.009
Chautaugua	1,474	4.47	0.003
Colgan	4,750	2.99	0.001
Continental[3]	5,536	56.64	0.010
Delta Air Lines[4]	21,308	205.58	0.010
DHL	246	4.67	0.019
Empresa Peru	30	0.34	0.011
FedEx	1,496	62.04	0.041
Frontier	565	5.05	0.009
GA	13,391	17.36	0.001
Horizon	75	0.26	0.003
Hyannis Air Service	16,873	0.72	<0.001
Iberia	222	7.53	0.034
Icelandair	464	9.88	0.021
Island Airlines	825	0.02	<0.001
Jet Charter	15	0.02	0.002
JetBlue Airways	31,964	264.65	0.008
Key Air	14	0.03	0.002
Lufthansa	866	35.60	0.041
Mesa	130	0.44	0.003
Miami Air	88	1.03	0.012
Other Air Carrier	40	0.35	0.009
Other International	26	1.50	0.058
Porter Airlines	1,571	1.48	0.001
Republic	2,198	7.62	0.003
Royal Air Freight	5	<0.01	<0.001
SATA International	200	3.80	0.019
Shuttle America	1,974	6.64	0.003
Southwest Airlines	8,706	84.87	0.010
Spirit	1,527	16.08	0.011
Sun Country	256	2.91	0.011
Swiss International	362	12.46	0.034
TACV-Cabo Verde	118	2.09	0.018
Trans States	303	0.92	0.003
Twin Cities Air Service	618	0.02	<0.001
United Air Lines	7,676	112.42	0.015
UPS Airlines	670	17.27	0.026
US Airways[5]	22,149	161.70	0.007
USA Jet	16	0.14	0.009
Virgin	360	15.97	0.044
Virgin America	1,513	15.01	0.010
Total	**184,494**	**1,504.43**	**0.008**

Source: Massport

Notes: Other International may include: Provincial Air, Saudi Arabian Airlines, etc.
The "Other" Categories may include airlines with less than 10 operations.
Normalized emissions are based on a Landing and Takeoff Cycle (LTO).
This list combines the major airlines with their commuters (i.e., American Eagle with American Airlines and Continental Airlines with Continental Express, etc.).
Cargo carriers include: Air Transport, Airnet, Capital Cargo, DHL, FedEx, Royal Air Freight, and UPS.
GA – General Aviation

1 Includes Jazz.
2 Includes American Eagle.
3 Includes Continental Express.
4 Includes Delta Connection and Delta Shuttle.
5 Includes US Airways Express.

Alternative Fuel Vehicles (AFV) Program

A component of Massport's Air Quality Management Program is the AFV Program. The AFV Program is designed to replace conventionally-fueled fleet with alternatively fueled or powered vehicles, when feasible, to help reduce emissions associated with Logan Airport operations. One Ford F-150 pick-up, four F-250 pick-ups, three F-350 pick-ups, one E-150 van, and four Escapes powered by E85 flex fuel were acquired in 2011. Massport now operates 72 vehicles powered by CNG, propane, electricity, E85 flex fuel, or hybrids powered by gasoline and alternative power sources. Table 7-15 shows the number of Massport AFVs by vehicle type and the number of vehicles Massport added to and removed from its fleet in 2011. As discussed in *Chapter 1, Introduction/Executive Summary,* several projects and programs support AFVs at Logan Airport including:

Logan Airport Clean Fuel Bus. Source: Massport

- The replacement of 94 rental car buses and older CNG buses with a fleet of 50 alternative fuel (diesel-electric hybrids and CNG) buses, which will serve the new Consolidated Rental Car Facility (ConRAC), Massport terminals and other shuttle routes. This project will be funded by the FAA's Voluntary Airport Low Emissions (VALE) Program grant;
- Operation for almost two decades of one of the largest privately operated, publicly-accessible, CNG stations in New England, which in 2011, dispensed approximately 29,900 gasoline-equivalent gallons per month for Massport vehicles and an additional 11,600 gasoline-equivalent gallons per month for other non-Massport vehicles;
- The introduction of battery powered tugs and belt loaders for the Delta Air Lines ground service fleet at Terminal A;
- Construction of the new ConRAC in the Southwest Service Area (SWSA) including electric vehicle charging stations that conform to the new North American fast-charging standard; renovation to the existing gas station in the North Cargo Area in 2008, which included the installation of an E85 (first-generation biofuel) fuel dispensing tank; and continued operation of Massport's "CleanAirCab" incentive program for AFVs, which allows hybrid or alternative fuel taxis to go to the head of the taxi line to serve passengers.

In addition, Logan Airport's new Green Bus Depot is designed to maintain the expanded CNG-fueled and clean diesel-electric hybrid shuttle bus fleet.

Massport also began offering preferred parking for customers driving hybrid and AFVs in the spring of 2007.

Table 7-15 Massport's Alternative Fuel Vehicle Fleet Inventory at Logan Airport

Fuel Type	Vehicle	Number
Electric	On-road vehicles	2
	Segways	2
Diesel/Electric	Bus	32
Compressed Natural Gas (CNG)	Ford Crown Victoria	1
	Van	2
	Pick-Up Truck	6
	Honda Civic	9
	Shuttle Bus	26
	Bus	18
Gasoline/Electric Hybrid	Ford Escape	8
Propane	Non-Road Vehicles (Forklifts)	2
E85 Flex Fuel	Crown Victoria	1
	Pick-Up Truck	8
	Van	1
	Ford Escape	4
	Total	**122**
	Total acquired in 2011	**13**
	Total acquired in 2012	**50**

Source: Massport.

Air Quality Management Goals

Massport's air quality management program focuses on decreasing emissions, when feasible, from all Airport-related sources, in addition to studying innovative means to achieve emissions reductions. Massport's air quality improvement goals, the measures proposed to accomplish them, and some 2011 milestones are presented in Table 7-16.

In addition to measures described in Table 7-16, Massport, through its involvement in the Massachusetts Clean Cities Program, has supported the education of the general public and corporate and public fleet managers with respect to sustainable transportation through its sponsorship and support of the Altwheels Transportation Festival and Altwheels Fleet Day since its inception in 2003.

Table 7-16 Air Quality Management Plan Status

Air Quality Emissions Reduction Goals	Plan Elements	2011 Status
Reduce emissions from Massport fleet vehicles	Convert Massport fleet vehicles to electricity or compressed natural gas (CNG) by retrofitting or procurement.	Massport procured 13 alternative fuel vehicle/alternative power vehicles (AFV/APV) in 2011. Massport uses the Energy Policy Act (EPAct) of 1992 to expedite Massport's AFV/APV program. Under EPAct, Massport is required to purchase 75 percent of its light-duty vehicles as AFVs, excluding public safety vehicles. There were a total of 7 accrued banked EPAct credits in 2011, up from 4 in 2010. In 2012, Massport acquired a fleet of 50 AFV (diesel-electric hybrids and CNG) buses, which will serve the new consolidated rental car facility (ConRAC), Massport terminals, and other shuttle routes.
Encourage use of alternative fuel and alternative power vehicles by private fleet and airside service vehicle owners	Provide infrastructure to support alternative fuels including CNG and electricity.	Massport continues to operate New England's CNG station, which is open to the public. In 2011, the CNG station dispensed approximately 41,500 gallon equivalents per month for all CNG vehicles, including Massport vehicles. Massport plans to support the current and future standard systems for plug-in electric vehicles (EVs). For example, the ConRAC currently under construction in the Southwest Service Area (SWSA) will include the infrastructure necessary to accommodate future plug-in stations for electric vehicles. Central Garage and Terminal B both have plug-ins for EVs.
	Work with ground access fleet and airside service-vehicle owners to encourage conversion.	Massport encourages conversion to AFVs/APVs by others through such policies as 50 percent discounts in AFV/APV ground access fees to limousines, vans, and buses; limited "front-of-line" taxi pool privileges to hybrid and AFVs/APVs; and preferred parking for hybrid and AFVs/APVs at Logan Airport parking facilities.
	Use of pre-conditioned air (PCA) at new and renovated terminals and terminal gates.	All contact gates have PCA and/or 400-Hz power. This reduces the need for auxiliary power unit (APUs) and, consequently, reduces associated emissions. The improvements of Terminal B will also include the installation of PCA at all renovated gates.
Minimize emissions from motor vehicles	Implement a program to increase high occupancy vehicle (HOV) ridership by air passengers.	As described in detail in *Chapter 5, Ground Access,* there are a number of HOV services serving Logan Airport that are aimed at air passengers, including the MBTA Blue Line and Sliver Line, Logan Express, and water transportation. Massport promotes the use of these services by employees, primarily through the Logan Airport Employee Transportation Management Association (Logan TMA) and various pricing incentives.
	Expand the Logan TMA for Airport employees.	The Logan TMA continues to provide commuting information to all Airport employees.
	Encourage employees to use bicycling as a mode of commuting.	Massport includes bike racks at all new facilities and at appropriate existing facilities to promote employees biking to work. Bicycle racks are currently provided at Terminal A, Terminal E, Logan Office Center, MBTA's Airport Station, Economy Parking Garage, Signature general aviation terminal, and the Green Bus Depot (Bus Maintenance Facility). Additional racks are planned in 2013 for the ConRAC facility.
Minimize emissions from Construction Equipment	Incorporate Clean Air Construction Initiative (CACI) into major earthwork construction projects.	For all construction projects heavy construction equipment is required to be equipped with diesel particulate filters or diesel oxidation catalysts in accordance with CACI.
Reduce emissions from fuel vapor loss	Provide state-of-the-art fuel storage and distribution equipment.	The Fuel Storage and Distribution System is in operation.
	Implement Tank Management Program.	Refer to *Chapter 8, Water Quality*. Tank management focuses on proper maintenance.
Reduce emissions from stationary sources	Employ Reasonable Available Control Technologies (RACT) for NO_x at Central Heating/Cooling Plant.	RACT policies have been implemented.
	Use alternative fuels in snow melters.	Ultra Low Sulfur Diesel (ULSD) fuel is used in all Massport snow melting equipment.
	Incorporate green building technologies and energy use reduction strategies.	Massport participates in the State Sustainability Program. Terminal A and the Signature Flight Support GA Facility are certified under the U.S. Green Building Council Leadership in Energy and Environmental Design® (LEED) Green Building Rating System™ and Terminal E features green building elements. An overview of sustainability initiatives is presented in *Chapter 1, Introduction/Executive Summary*.

Table 7-16 Air Quality Management Plan Status

Air Quality Emissions Reduction Goals	Plan Elements	2011 Status
	On-site renewable energy	Massport has installed and is planning to expand on-site renewable energy systems in the form of Solar Photovoltaic (Solar PV) panels and micro-wind turbines. Further details on these installations can be found in *Chapter 1, Introduction/Executive Summary.*
Reduce aircraft emissions	Work with the FAA to study and implement airfield-improvement concepts and operational changes that may have air quality benefits.	Massport promoted such concepts through the Logan Airside Improvements Planning Project Environmental Impact Statement, which recommended physical and operational improvements to Logan Airport including construction of the new Runway 14-32 and Centerfield Taxiway, and taxiway improvements. Runway 14-32 became operational in November 2006 and the Centerfield Taxiway was fully opened in summer of 2009. In addition, in coordination with Massport, the Massachusetts Institute of Technology (MIT) completed a detailed survey of pilots at Logan Airport to better understand the use of single engine taxiing and issued a paper in March 2010, and in January 2011, MIT issued a paper on aircraft pushback control strategy to reduce congestion and taxi delay (Appendix L). Massport will communicate with airlines regarding the use of single engine taxiing, when safe to do so, within the Logan Airport operational context.

Source: Massport

Updates on Other Air Quality Initiatives

This section highlights other air quality initiatives at Massport in 2011.

Massachusetts Department of Public Health Study

In 2004, the Massachusetts Legislature appropriated funds for the Department of Public Health (DPH) to undertake an assessment of potential health impacts of Logan Airport in the East Boston neighborhood and any other communities located within a five-mile radius of the Airport. With the focus on noise and air quality, this study is currently underway and consists of an epidemiological survey combined with computer modeling of noise levels and air pollution concentrations. Massport has cooperated in this effort by providing funding to complete the study and Airport operational data in support of it. In the spring of 2011, Massport also gave technical assistance in support of the DPH study by providing geographic information systems (GIS) analysis of the roadway network in and around Logan Airport in a format compatible with the FAA's EDMS. DPH expects to publicly release the report in 2013.

Massport Air Quality Monitoring Study

Massport has now completed a $1.6 million air quality monitoring study in and around Logan Airport in compliance with its MEPA Section 61 findings for the Centerfield Taxiway component of the Logan Airside Improvements Project. The study gathered air quality data in the communities around Logan Airport before and after the new Centerfield Taxiway became operational, with an emphasis on ambient (i.e., "outdoor") levels of particulate matter and hazardous air pollutants (HAPs). The intent of the study was to assess potential air quality changes related to the operation of the new taxiway. Massport worked cooperatively with MassDEP and DPH to develop the scope of the monitoring study.

Air monitoring commenced in 2007 at ten different stations located on and off the Airport. The monitoring comprised both "real-time" and "time-integrated" monitoring methods, and includes measurement of fine particulates, VOCs, carbonyls, black carbon, and polynuclear aromatic hydrocarbons (PAHs). Massport also met periodically with MassDEP and DPH regarding the progress and results of the air monitoring.

The first year of the two-year study was completed September 2008 and the report is posted on Massport's website. The second phase of the Study concluded in September 2012 following the completion of the Centerfield Taxiway which is now fully operational. The findings from this Study will be submitted to MassDEP in 2013. For details on the study and report see Massport's website at: www.massport.com/environment/environmental_reporting/Air%20Quality/NitrogenDioxideMonitoring.aspx.

Single Engine Taxiing

Single engine taxiing is one measure that is being used by air carriers to help reduce fuel use and emissions. As a result, Massport supports the use of single engine taxiing, when it can be done safely, voluntarily and at the discretion of the pilot. Massport has conducted three surveys of Logan Airport air carriers (2006, 2009, and 2010) to understand the extent single engine taxiing is used at Logan Airport. In addition, Massport is an active member of the FAA Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) program on reducing noise and emissions. In 2009, Massport offered to facilitate the undertaking by the Massachusetts Institute of Technology (MIT) of a more detailed survey of pilots at Logan Airport to better understand the use of single engine taxiing. MIT completed its survey and issued a paper in March 2010, which was provided in the *2009 EDR*. The MIT survey confirms earlier Massport survey findings that single engine taxiing is an important operational measure used by airlines to conserve fuel and is extensively used at Logan Airport. MIT issued a paper in January 2011 reporting on a control strategy to minimize airport surface congestion, and thus taxiing time, by regulating the rate at which aircraft are pushed back from their gates. A copy of this paper is provided in *Appendix L, Demonstration of Reduced Airport Congestion through Pushback Rate Control*. Also in January 2011, Massport sent a memorandum to air carriers in support of single engine taxiing when consistent with safety procedures. The memorandum highlighted best practices for single engine taxiing use based on the MIT survey findings. A copy of this memorandum is provided in *Appendix M, Reduced Single Engine Taxiing at Logan Airport Memorandum.*

MIT and the Center for Air Transportation Systems Research developed a methodology to account for single engine taxi procedures during the taxi in or out modes.[25,26,27] Some of the single engine taxi challenges noted in these studies include: (1) excessive thrust and associated issues; (2) maneuverability problems, particularly related to tight taxiways turns and weather; (3) problems starting the second engine; and (4) distractions and workload issues. Thus, pilots do not use single engine taxiing during each aircraft operation in practice, and when they do use it, it is not for the entire operation. Pilots use it even less often during taxi out. The following assumptions were developed based on available information such as aircraft pilot surveys:

- Practiced during 75 percent of the arrivals (based on pilot surveys). When practiced, conducted 3.1 minutes after landing (engines cool down period).
- Thus, the 2011 taxi in time of 7.0 minutes would involve 3.1 minutes of required full engine usage, of the remaining 3.9 minutes; a single engine taxi procedure would be employed 75 percent of the aircraft operations. The resultant taxi in time would be 5.5 minutes.
- Practiced during 10 percent of the departures (based on pilot surveys). When practiced, conducted 4.6 minutes before takeoff (engines warm up period).

25 *A Survey of Airline Pilots Regarding Fuel Conservation Procedures for Taxi Operations*, Massachusetts Institute of Technology.
26 *Opportunities for Reducing Surface Emissions through Airport Surface Movement Optimization*, Massachusetts Institute of Technology, 2008.
27 Analysis of Emissions Inventory for Single Engine Taxi-out Operations, Center for Air Transportation Systems Research.

- Thus, the 2011 taxi out time of 18.2 minutes would involve 4.6 minutes of required full engine usage, of the remaining 13.6 minutes; a single engine taxi procedure would be employed 10 percent of the aircraft operations. The resultant taxi in time would be 17.5 minutes.
- Practiced with aircraft with two engines, but not aircraft with more than two engines.

The resulting taxi times (relative to the use of two engines) at Logan Airport during 2011 would be reduced from 7.0 to 5.5 minutes (taxi in) and from 18.2 to 17.5 minutes (taxi out) or 9 percent reduction in total taxi time (and fuel usage during taxiing) for applicable aircraft operations. As a result of single engine taxi practices, approximately 1,477,000 gallons of jet fuel were saved during 2011; resulting in the reduction of 14,335 metric tons of GHG emissions.

Logan Airport Energy Planning

In an effort to reduce energy consumption and air emissions associated with the Central Utility Plant, Massport commissioned a study to evaluate operational, economic and environmental benefits through cogeneration.[28] In general, institutional, manufacturing, and large commercial facilities such as Logan Airport require both thermal energy (heat) and electricity. Traditionally, as is the case with Logan Airport, these products have been produced in two separate processes. Thermal energy is produced with a boiler while electricity is typically purchased from an electric utility or third party supplier, which generates power through a large central plant. By generating electricity alone, 67 percent of the available energy in the fuel is lost due to heat rejection and inherent system processing inefficiencies. By combining the two processes into one, the waste heat is captured and used as thermal energy. This process is referred to as cogeneration or a Combined Cooling, Heat and Power (CCHP) Plant. The potential benefits of developing a CCHP could enhance Logan Airport's energy profile by improving the operations of its Central Utility Plant to serve Logan Airport's thermal needs and a portion of its electrical requirements. The cogeneration study identified five different potentially feasible options for a CCHP that could satisfy the needs of the Airport and reduce its energy consumption Airport-wide. Massport is currently reviewing the results of this study.

In 2009, Massport began preparing an Energy Master Plan for all Massport facilities. The planning process involved data collection and establishing regulatory targets and baselines. One of the goals of the Energy Master Plan is to help Massport meet the State's Leading by Example Clean Building Targets[29], which by 2012, aim to reduce GHG from state-controlled buildings by 25 percent, reduce energy intensity at state-owned and leased buildings by square foot by 20 percent, and procure 15 percent of energy through renewable energy sources. The Energy Master Plan will provide Massport with a comprehensive strategy to reduce energy use using a portfolio of achievable measures that will result in quantifiable energy savings and cost reduction. In 2010, the Massport Board approved the Energy Master Plan and approved funding to implement energy efficiency improvements targeted at achieving energy and renewable energy targets as defined by the Governor's Executive Order 484 - Leading by Example.

Southwest Service Area Redevelopment Program

The principal feature of the SWSA Redevelopment Program is the consolidation of the rental cars (ConRAC) and associated functions. The ConRAC will consolidate on-airport rental car operations and facilities into one integrated user-friendly facility in order to better serve both the tenants and the traveling public, and reduce ground

28 *Logan International Airport Energy Strategic Plan*, prepared for Massport, prepared by Source One, February 2008.
29 Massachusetts' *Leading By Example Program* is intended to reduce the environmental impacts of state government buildings and operations. The program includes energy efficiency standards for state buildings, such as clean energy and greenhouse gas goals, and as well as sustainable practices such as waste reduction, water conservation, and recycling.

transportation and air quality impacts on-Airport and off-Airport in the surrounding neighborhoods. The ConRAC is designed and is being constructed and operated for Leadership in Energy and Environmental Design® (LEED) certification (striving to achieve a LEED Silver rating or better) and to meet the Massachusetts LEED Plus sustainable design and construction standards established by the Commonwealth's Executive Office for Administration and Finance.[30]

By constructing an on-site consolidated rental car facility, the ConRAC will reduce the need for the rental car operators to shuttle vehicles from off-Airport storage locations, resulting in fewer VMT and lower air emissions (including mobile source GHG emissions) within the East Boston community, Route 1A, and adjacent neighborhoods. Through the implementation of the Unified Bus System, the new ConRAC will facilitate the reduction of the current rental car shuttle bus fleet by 70 percent and the associated VMTs, and air emissions. The Unified Bus System will use clean fuels (CNG and clean diesel-electric hybrid), further reducing emissions compared to the existing rental car bus fleet. Also, the Unified Bus System includes combining the rental car shuttle bus service with existing Massport buses that service the Massachusetts Bay Transportation Authority (MBTA) Blue Line Airport Station (routes 22/33/55), resulting in further decreases to the size of the overall bus fleet serving the Airport, and reduced VMT and air emissions. Other air quality benefits of the SWSA Redevelopment Program include the reduction of curb-side congestion at the main terminal complex through implementation of the Unified Bus System and reduced overall energy demand (and associated stationary source GHG emissions) through improved building energy design.

On May 28, 2010, the Secretary of EOEEA issued a Certificate that determined that the project adequately and properly complies with MEPA and is under construction. *Chapter 3, Airport Planning* provides detail on the environmental and operational benefits of the SWSA Redevelopment Program related to the consolidation of ground transportation facilities and services and traffic circulation and access improvements. Benefits of the consolidation will include customer service improvements, environmental management enhancements, reduced VMT and the associated reductions in air emissions. ConRAC construction began in July 2010, starting with various enabling phases of construction and will be completed in 2014.

Engagement in Aviation-Related Environmental Issues

Massport maintains memberships and active participation in a number of organizations involved in addressing aviation-related environmental issues, including air quality. These include serving on environmental committees for the TRB, AAAE, ACI, and Women's Transportation Seminar (WTS) and symposia.

Ultrafine Particles (UFP)

To date, there are no Massachusetts or Federal air quality standards for the emissions or the ambient levels of UFP due to limited health effects evidence and air quality data.[31] Future ESPRs/EDRs will report on UFP standards as they develop. The monitoring of UFP is being conducted at two airports in the U.S. but the data from these programs is preliminary and not necessarily adaptable to other airports. These UFP monitoring studies include the following:

- T.F. Green Airport (PVD) – Located in Warwick R.I., this UFP monitoring study is being conducted by the Rhode Island Airport Cooperation (RIAC) in accordance with state regulations. Under this multi-year program, UFP are being measured continuously at four sites located around the perimiter of the airport.

30 According to Executive Order 484, titled "Leading by Example: Clean Energy and Efficient Buildings," all new construction and significant renovation projects for state government buildings over 20,000 square feet must meet the Massachusetts LEED* Plus green building standard.

31 National Ambient Air Quality Standards for Particulate Matter, Final Rule, "*Federal Register* 78:10 (15 January 2013) p. 3122.

Weather data (i.e., wind direction and speed) are also being collected. The UFP data from this program are provided to the Rhode Island Department of Environmental Management (RIDEM), but no findings or relationships to airport activity have been reported thus far.

- Los Angeles International Airport (LAX) – UFP are being measured at this California airport as part of a research study being undertaken by Los Angeles World Airports. In this study, UFPs are being measured over two seasonal campaigns at locations both on and off the airport property. Again, meteorological data are being collected along with airport operational data as a means of ascertaining the source(s) of the UFP. This study is still underway and therefore the results are not yet available.

Statewide, National and International Initiatives

Advancements on the national and international levels to decrease Airport-related air emissions has continued to focused primarily on three initiatives in 2011: (1) the advanced quantification of PM and HAPs emissions from aircraft engines; (2) the continued phasing-in of AFV; and (3) the implementation of GHG emissions reduction strategies. These initiatives are briefly described as follows.

- **Particulate Matter and Hazardous Air Pollutant Research—**Conducted by the FAA/National Aeronautics and Space Administration (NASA)/EPA and others, research continues to better characterize PM and HAPs emissions from aircraft engines and to assess their potential health effects. Similarly, air quality monitoring efforts at other airports are also underway (or planned) at various locations to advance what is known about ambient ("outdoor") levels of air pollutants in the vicinities of the nation's airports.[32] In addition to conducting its own air monitoring programs (see updates on the Measured NO_2 Concentrations Report and Massport Air Quality Monitoring Study, above), Massport continues to closely track these issues through its involvement in aviation industry organizations such as ACI and AAAE.
- **Alternative Fuel Vehicle Conversions—**Airlines and other GSE users are continually replacing their older fossil-fueled vehicles and equipment with more fuel-efficient, low- and non-emitting (e.g., electric) technologies. Airport-fleet vehicles are also being converted to alternative fuels (e.g., propane). In response, GSE and automobile manufacturers are offering a wider selection of AFVs, many of which are designed specifically for airport use. Massport continues to support the conversion of fossil-fueled vehicles and equipment to alternative or lower-emitting fuels.
- **Participation in Massachusetts Climate Protection Plan—**Massport was one of 15 state agencies and authorities that participated in the development of the state's Climate Protection Plan: the Commonwealth's initial step towards reducing GHG. Massport is participating on two of the Plan's teams: Transportation System Planning and Transportation Technologies and Operations, with a focus in GHG emission reductions associated with Airport operations. Current reduction strategies include:
  - Include energy use and GHG emissions as criteria in transportation decisions;
  - Maintain and update public transit systems;
  - Expand programs to promote efficient travel;
  - Seek opportunities to reduce emissions at Logan Airport;
  - Improve aircraft movement efficiency;
  - Promote the use of cleaner vehicles and fuels in public transit fleets;
  - Continue to promote the use of clean diesel equipment on publicly-funded construction projects;
  - Eliminate unnecessary idling of buses; and
  - Advocate for aircraft efficiency at regional and national levels.

32 These air quality monitoring programs at other airports include T.F. Green Airport (Providence, R.I.); Los Angeles International and Santa Monica Airports in CA.

In August 2008, the Commonwealth passed the Global Warming Solutions Act (GWSA). The GWSA requires the reduction of GHG emissions by 80 percent from 1990 levels by 2050, with a reduction of up to 25 percent by 2020. In May of 2012, EOEEA Secretary convened an Implementation Advisory Committee (IAC) that will advise the Commonwealth's implementation of the GWSA. The IAC features leaders from the business, energy, environmental, building, transportation, and academic communities in Massachusetts. Massport is participating on the Climate Adaptation subcommittee of the IAC.

On a parallel track, to address adaptation, the Commonwealth also commenced a Climate Change Adaptation project. An Advisory Committee was established to define and assess potential state-wide vulnerabilities associated with potential climate change impacts, and evaluate strategies for adapting to the predicted effects of climate change. In this ongoing effort, and since October 2009, Massport participated in the transportation sector meetings of the "Key Infrastructure" working group. In addition to considering potential impacts to Massport and other statewide maritime facilities, the Key Infrastructure team examines the potential issues at airports related to service disruption, access issues, flooding, and other storm-related impacts.

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8 Water Quality/ Environmental Compliance and Management

Introduction

The Massachusetts Port Authority's (Massport's) approach to environmental management and compliance is a key component of its commitment to sustainability and responsible stewardship at Logan Airport (refer to *Chapter 1, Introduction/Executive Summary* for details). Through monitoring and documentation, environmental performance is assessed, allowing policies and programs to be developed, implemented, evaluated, and continuously improved.

Massport's primary water quality goal is to prevent or minimize pollutant discharges, thus limiting adverse water quality impacts associated with airport activities. Massport employs several programs to promote awareness of Massport and tenant activities that may impact surface and groundwater quality, thus improving water quality. Programs include implementing best management practices (BMPs) for pollution prevention by Massport, its tenants, and its construction contractors; training of staff and tenants, and a comprehensive stormwater pollution prevention plan. In addition, Massport voluntarily participates in the State's Leading by Example Program,[1] continuing its commitment to operate Logan Airport in an environmentally sound manner. Massport complies with the Massachusetts Contingency Plan (MCP) by monitoring fuel spills and tracks the status of spill response actions. The MCP lays out a set of regulations that govern the reporting, assessment, and cleanup of spills of oil and hazardous materials in Massachusetts.[2] Massport also maintains a Tank Management Program, which includes a tank permitting, monitoring, upgrade, and replacement program. Information on Massport's Logan Airport Stormwater Pollution Prevention Plan (SWPPP)[3], Spill Prevention Control and Countermeasure Plan (SPCC)[4], and the MCP are provided in this chapter.

1 Massachusetts' Leading By Example Program is intended to reduce the environmental impacts of state government buildings and operations. The program includes energy efficiency standards for state buildings, such as clean energy and greenhouse gas goals, and as well as sustainable practices such as waste reduction, water conservation, and recycling.
2 310 Code of Massachusetts Regulations (CMR) 40.0000.
3 In accordance with the requirements of the current Logan Airport NPDES stormwater permit that was issued on July 31, 2007, Massport and its co-permittees were required to develop SWPPPs.
4 In accordance with the Clean Water Act, 40 CFR 112, *Oil Pollution Prevention*.

The federal Clean Water Act (CWA) requires permits for pollutant discharges into U.S. waters from point sources and for stormwater discharges associated with industrial activities. Massport holds permits under the U.S. Environmental Protection Agency's (EPA) and Massachusetts Department of Environmental Protection's (MassDEP) National Pollutant Discharge Elimination System (NPDES) Program. The NPDES permit covers Massport and its co-permittees at Logan Airport. It establishes effluent limitations and monitoring requirements for discharges from specified stormwater outfalls.

Massport is responsible for ensuring compliance with applicable state and federal environmental laws and regulations. Massport promotes appropriate environmental practices through pollution prevention and remediation measures. Massport also works closely with airport tenants and airport operations staff in an effort to improve compliance. Massport's environmental programs pertaining to water quality and environmental compliance and management include:

- Stormwater management;
- Water quality management;
- Fuel use and spills;
- MCP compliance;
- Storage tank compliance;
- Compliance auditing and inspections;
- Environmental Management System (EMS) implementation; and
- Clean State Initiative and Leading by Example Program participation.

Key Findings

The following summarizes the key water quality and compliance findings for 2011:

- International Organization for Standardization (ISO) 14001 certification for Facilities II (vehicle maintenance, landscaping, and snow removal) began in December 2006. Recertification of Facilities II was obtained in December 2009. In 2010, Massport began the process of expanding the Logan Airport EMS to include Facilities I (Central Heating and Cooling Plant), Facilities II (Vehicle Maintenance, Landscaping, and Snow Removal), and Facilities III (Electrical and Structural). A certification audit of the expanded Logan Airport EMS took place in early June 2011, and a certificate was issued in July 2011. The current Logan Airport EMS covers Facilities I (Central Heating and Cooling Plant), Facilities II (vehicle maintenance, landscaping, and snow removal), and Facilities III (Electrical and Structural).
- In 2011, there were 12 oil and hazardous material spills that required reporting to MassDEP, five of which involved a storm drainage system.[5] Further details on spills can be found in the *Fuel Use and Spills* section of this chapter.
- One outfall sample out of a total of 19 samples at the Maverick Street Outfall and one outfall sample out of a total of 23 samples at the North Outfall exceeded the regulatory limits of the NPDES Permit for the North, West, and Maverick Street Outfalls. These exceedances were reported in April and November 2011, respectively, as required.

5 State environmental regulations require that oil spills of 10 gallons or more in volume be reported to MassDEP.

- Massport's SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemicals, potential bacteria, fuel and oil, and other sources of stormwater pollutants. The 2011 Annual Certificates of Compliance were submitted to EPA and MassDEP on December 13, 2011, for Massport and each tenant co-permittee.
- In accordance with the MCP, Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. Massport is working towards achieving regulatory closure of the remaining MCP sites associated with known releases, as well as addressing sites encountered during construction. Progress has been made for all MCP sites with updates included in Table 8-3.

Stormwater Management in 2011

On July 31, 2007, EPA and MassDEP issued an individual NPDES Stormwater permit for Logan International Airport (NPDES Permit MA0000787). The new permit became effective on September 29, 2007, replacing the previous NPDES Permit dated March 1, 1978. The NPDES permit is on EPA's website at: www.epa.gov/NE/npdes/logan/pdfs/finalma0000787permit.pdf. Massport holds a separate NPDES permit for the Fire Training Facility (NPDES Permit MA0032751). The following sections describe the requirements of the two permits, and Massport's compliance with these requirements.

Stormwater Outfall NPDES Permit Requirements and Compliance

The following sections describe stormwater outfalls that are subject to the NPDES Permit, the monitoring requirements, and the monitoring results for 2011.

Outfalls Subject to the NPDES Permit

The NPDES permit regulates stormwater discharges from the North, West, Northwest, Porter Street, and Maverick Street Outfalls, and all of the airfield outfalls. The areas drained by the outfalls are the North Drainage Area (152 acres); West Drainage Area (557 acres); Northwest Drainage Area (23 acres); Porter Street Drainage Area (130 acres); Maverick Street Drainage Area (34 acres); and the Airfield Outfall Drainage Areas (A1 through A44) which drain the remainder of the airfield including runways, taxiways, and the perimeter roadway (910 acres). The North and West Drainage Areas also drain a portion of the airfield. These drainage areas are shown in Figure 8-1 and further detailed in Table 8-1. The North and West Outfalls have end-of-pipe pollution control facilities for the removal of debris and floating oil and grease from stormwater prior to discharge into Boston Harbor.

Table 8-1 Stormwater Outfalls Subject to NPDES Permit Requirements			
Outfall Name and Number	**Drainage Area (Acres)**	**Boston Harbor Discharge Location**	**Major Land Uses**
North (001)	152	Wood Island Bay	Terminal E, apron, taxiway, cargo areas, fuel farms, and runways
West (002)	557	Bird Island Flats	Taxiways, terminal areas, aprons, cargo areas, and runways
Porter Street (003)	130	Bird Island Flats	Hangars, vehicle maintenance facilities, cargo areas, car rental facilities, and roadways
Maverick Street (004)	34	Jeffries Cove	Car rental facilities, taxi/bus/limousine pools, parking areas, flight kitchens
Northwest (005)	23	Wood Island Bay	Flight kitchen, vacant area being used for construction lay down and staging
Airfield (A1 through A44)[1]	910	Perimeter of Airfield	Runways, taxiways, and perimeter roadway

Source: Massport

1 In accordance with the requirements of the NPDES permit, Massport developed an Airfield Stormwater Outfall Sampling Plan (March 27, 2008). The Plan requires quarterly wet weather sampling at a minimum of seven of the airfield outfalls (A1 through A44) in order to obtain representative samples of the quality of stormwater runoff from the airfield.

Monitoring Requirements

The NPDES permit requires grab samples (single samples collected at a particular time and place) to be taken monthly from the North, West, Porter Street, and Maverick Street Outfalls. Samples are tested for pH, oil and grease, total suspended solids (TSS), benzene, surfactants, fecal coliform bacteria, and *Enterococcus* bacteria during both wet and dry weather. Grab samples are also taken quarterly from these four outfalls during wet weather to test for eight different polycyclic aromatic hydrocarbons (PAHs).

Figure 8-1 Logan Airport Outfalls

Source: Aerial photo Massport

Additional sampling requirements of the NPDES permit include sampling for deicing compounds twice during the deicing season (October through April) at the North, West, and Porter Street Outfalls. The NPDES permit sets discharge limitations for pH, oil, and grease, and TSS from the North, West, and Maverick Street Outfalls and for pH from the Porter Street Outfall. The NPDES permit does not include any discharge limitations for the Northwest Outfall, airfield outfalls, or the deicing monitoring, and requires only that the sampling results be reported. *Appendix J, Water Quality/ Environmental Compliance and Management* contains additional information on the sampling requirements of the NPDES permit.

Monitoring Results

During 2011, two stormwater samples taken at the West Outfall exceeded the limits for TSS and oil and grease and three stormwater samples taken at the Maverick Street Outfall exceeded the limits for TSS established in the NPDES permit. The TSS and oil and grease exceedances at the West Outfall occurred during two separate sampling events on January 18 and April 13, 2011. The TSS exceedances at the Maverick Street Outfall occurred during three separate sampling events on March 11, July 25, and November 3, 2011.

Stormwater samples taken at the West Outfall on January 18, 2011, exceeded the 100 milligrams per liter (mg/L) daily maximum limit for TSS and the 15 mg/L daily maximum limit for oil and grease established in the NPDES permit. The analytical results for the sample indicated a concentration of 230 mg/L for TSS and 28 mg/L for oil and grease. As indicated in the Discharge Monitoring Report dated February 15, 2011, the exceedances of the TSS and oil and grease discharge limit at the West Outfall may be attributable to the amount of precipitation that occurred on the sampling date. Prior to the sampling date, there was a significant snow event followed by five days of dry weather. The excessive runoff generated on the sampling date, which included stormwater and snow melt, carried a higher than normal pollutant loading due to accumulated sediment and other stormwater contaminants such as oil and grease associated with roadways and paved areas.

The second TSS and oil and grease exceedance at the West Outfall occurred in a stormwater sample taken on April 13, 2011. The analytical results for the sample indicated a concentration of 560 mg/L for TSS and 24 mg/L for oil and grease. Upon being informed of the exceedances, Massport inspected activities within the 450-acre West Outfall drainage area to identify potential sources of the TSS and petroleum detected in the outfall samples. As reported in the Discharge Monitoring Report dated May 16, 2011, Massport found no specific sources. It is possible that the rainfall event that occurred during the stormwater sampling following a relatively dry month generated the increased pollutant loading.

An exceedance of the TSS discharge limit established by the NPDES permit at the Maverick Street Outfall occurred in a stormwater sample obtained on March 11, 2011. The analytical results for the sample indicated a concentration of 110 mg/L which exceeds the limit of 100 mg/L for TSS. Prior to the exceedance, Massport had notified its tenants who operate within the Maverick Street Outfall drainage area to inspect and clean catch basins as required at the end of the winter roadway sanding period. Massport confirmed that all tenants conducted these activities and daily sweeping continues of all paved areas.

A second exceedance of the TSS discharge limit at the Maverick Street Outfall occurred in a stormwater sample obtained on July 25, 2011. The analytical results for the sample indicated a concentration of 370 mg/L. Massport conducted an inspection of the Maverick Street Outfall drainage area following the exceedance. The drainage area is located within the Southwest Service Areas of Logan Airport which is undergoing construction activity associated with Massport’s Consolidated Rental Car Facility (ConRAC) Project. During the inspection, significant quantities of stockpiled soil were observed although no siltation was observed at the outfall and appropriate sedimentation controls were in place throughout the construction area. Massport directed its contractor for the ConRAC project to replace the catch basin inserts and wattles and remove any

accumulated sediment from the catch basin locations. A follow-up inspection confirmed that these activities occurred.

The final exceedance of the NPDES permit discharge limits observed at Logan Airport during 2011 was an exceedance in the TSS discharge limit at the Maverick Street Outfall. The stormwater sample obtained on November 3, 2011 was found to have a TSS concentration of 150 mg/L. Similar to the July exceedance of the TSS discharge limit, Massport again directed the ConRAC contractor and field inspectors to conduct a thorough inspection of the construction area, in addition to their routine weekly NPDES inspection, and also confirm that there was no dewatering occurring that could impact the stormwater drainage system. The inspection identified three catch basin filter inserts that were filled or deteriorated. These deficiencies were corrected. There was no construction dewatering observed during the inspection that would have impacted the drainage system.

There were no TSS exceedances reported at the North Outfall or at the Porter Street Outfalls. The highest concentration of TSS observed at the North Outfall was 40 mg/L, which occurred on February 25 and November 10, 2011. The highest TSS concentration observed at the Porter Street Outfalls was 81 mg/L of TSS (July 25, 2011). There were no other exceedances for the other NPDES permit discharge limits, which include oil and grease and pH.

The NPDES permit requires only that sampling results be reported for the Northwest Outfall and airfield outfalls, and the permit does not contain discharge limits for these outfalls. The highest concentrations observed at the Northwest Outfall were 11 mg/L of oil and grease (February 25, 2011) and 170 mg/L of TSS (February 25, 2011). The highest concentrations observed at the airfield outfalls were less than 4.4 mg/L of oil and grease and 200 mg/L of TSS on July 8, 2011.[6] Deicing sampling at the North, West, Porter Street, and airfield outfalls occurred in January and February 2011 are reported as required by the EPA and MassDEP (see Tables J-12 and J-13 in *Appendix J, Water Quality/ Environmental Compliance and Management).*

The NPDES water quality monitoring results are posted on Massport's website (http://www.massport.com/environment/environmental_reporting/Water%20Quality/MonitoringResults.aspx), and Massport provides copies of the monitoring results to EPA and MassDEP.

Due to the large size of the drainage areas and relatively low concentration of pollutants, it is not always possible to trace exceedances to specific events. Where a known event such as a spill is reported, Massport routinely checks the drainage system for impacts from the event and takes corrective actions if necessary. The 2011 water quality monitoring results for discharge from the outfalls is provided in *Appendix J, Water Quality/ Environmental Compliance and Management* along with the history of water quality monitoring results that dates back to 1993.

Stormwater and Sanitary Sewer System Inspections and Repairs

Between 2006 and 2008, Massport conducted inspections of the sanitary sewer and stormwater drainage system serving Logan Airport to document the condition of the systems and identify potential impacts from the sewer to the stormwater drainage system. Such impacts could result from leaks or breaks from the sanitary sewer or from direct, inadvertent, illegal cross connections to the stormwater drainage system. As a result of

6 The 2008 NPDES permit does not set maximum daily discharge limitations for the Runway/Perimeter Stormwater Outfalls.

these surveys, the Boston Water and Sewer Commission (BWSC) completed replacement of sections of the sanitary sewer during 2009 and 2010.

Massport is in the process of preparing construction documents for repairing sections of the sanitary sewer system and the total estimated cost of the repairs is approximately $500,000. The extent and complexity of the repair work is greater than what was previously assumed and it has been necessary for Massport to retain an outside consultant to design the repairs. The repair work is scheduled to begin during the first quarter of 2013 and the completion of the work is anticipated by mid-2013.

In 2011, Massport's Facilities Department conducted inspections and cleaning of manhole and catch basin structures at locations throughout the Airport. In accordance with Part I.B.10.h of the Logan Airport NPDES Permit, the inspection and cleaning activities focused on structures within 100 yards of aircraft, vehicle, and equipment maintenance facilities. Unlike the inspection/cleaning program completed in 2010, the work conducted in 2011 did not include the drainage system located within the Southwest Service Area, which is presently under construction. A total of 71 manhole and catch basin structures were accessed in 2011 and their conditions were documented. Sediment depths were recorded and the sediment was then removed, as necessary, from the structures. A total of approximately 10 cubic yards of sediment and debris was removed during cleaning of the structures. In addition to the inspection and cleaning of manhole and catch basin structures, Massport directed its term contractor to inspect and clean 11 water quality construction structures (i.e., stormceptor units). The condition of the units was documented and approximately 25 cubic yards of sediment and debris was removed.

Bacteria Source Tracking

In accordance with Part I.B.9 of the Logan Airport NPDES Permit, Massport has implemented a SWPPP to investigate potential sources of bacteria in the stormwater runoff. Massport's worked with the MassDEP Wall Experiment Station (WES) to develop a sampling and analysis plan to evaluate sources of bacteria including the potential presence of bird feces in the stormwater discharges at the North Outfall. In the fall of 2010, Massport's contractor collected stormwater samples at the North Outfall, in addition to collecting a sample of bird fecal matter, for laboratory analysis. The laboratory conducted technologically advanced analyses of the samples using DNA data to identify potential bird markers in the stormwater. The stormwater samples were also analyzed for human markers and fluorescent whitening agents. The DNA testing conducted by the WES laboratory to identify potential bird markers in the stormwater was inconclusive. Due to limited resources available to the laboratory, further DNA testing of samples was suspended. The results of the analysis conducted on stormwater samples for the presence of human markers were mixed; some results were inconclusive, while others indicated that no human markers were present in the stormwater samples.

Fire Training Facility NPDES Permit Requirements and Compliance

NPDES Permit No. MA00327517 regulates treated wastewater from the Fire Training Facility on Governors Island (Figure 8-1). The treated wastewater from fire training exercises is stored, treated by separation and a carbon filter to remove fuel contaminants, and is typically beneficially reused onsite to recharge the fire training pit. If no storage is available, treated wastewater is tested prior to discharge to the storm sewer to ensure compliance with the Fire Training Facility's NPDES permit. Discharge monitoring reports are submitted monthly to EPA. In 2011, Massport reused all but approximately 20,000 gallons of

7 NPDES Permit No. MA0032751 - *Logan International Airport Fire Training Facility*. Issued November 1, 2006.

wastewater generated at the Fire Training Facility. The excess water was shipped off-site for disposal at NewStream located in Attleboro, Massachusetts.

Fuel Use and Spills in 2011

Management of fueling operations at Logan Airport is designed to minimize impacts on water quality through the implementation of Stormwater Pollution Prevention BMPs, including the use of reliable storage, secondary containment, and effective spill cleanup procedures. Massport's jet fuel storage and distribution infrastructure, installed in 2000 and 2001, includes a zoned leak detection system for underground fuel piping, which identifies volumetric changes of product in the pipe at operating pressure and zero pressure. The system combined the storage facility with a hydrant fuel system that reduced the need for trucks and dispensing. The former fuel farms were removed in 2000.

The fuel storage and distribution system was designed to ensure, to the extent technologically feasible, the reliable detection of leaks. The aboveground jet fuel storage facility and distribution system are leased and operated by a single party, BOSFUEL, an airline consortium. The management of the facility by one entity was put in place to minimize potential fuel spills and maximize water quality protection for the storage and distribution facilities. Cathodic protection, leak detection, secondary containment, and tank overfill protection methods such as alarms, inventory gauging sensors in the tanks, and emergency fuel shut-off systems have been installed. The operation and maintenance of these controls have been included in the Operation and Maintenance Manual used by BOSFUEL's contractor to operate and maintain the facility. Built-in environmental controls, unified operations, and the ongoing contingency planning provide heightened environmental protection and more efficient fuel handling operations than the previous system. In 2010, BOSFUEL, in coordination with Massport, completed the replacement of the portion of the jet fuel distribution system that had not been part of the fuel storage and distribution system improvements completed in 2001. The fuel line replacement, which began in 2008, involved the installation of approximately 6,500 linear feet of pipe in the vicinity of Terminals B and C.

The Massport Fire Rescue Department keeps logs of all spills at Logan Airport (see Table 8-2). State environmental regulations require that oil spills of 10 gallons or more in volume be reported to MassDEP. Spills that enter storm drains of any volume must also be reported to Massport. During 2011, five of the spills entered the storm drainage system. Massport keeps records of all spills, including those less than the reporting threshold. In 2011, of the 108 oil and hazardous material spills reported to the Massport Fire Rescue Department, 12 spills (11 percent) were reportable, due to their volume. Of the 12 reportable spills, six commercial airlines were responsible for eight of the spills; one fixed-based operator was responsible for two spills; one spill was the result of equipment failure; and one spill was the result of a bus accident. By volume, jet fuel spills accounted for 59 percent of total fuel spilled; diesel fuel accounted for 10 percent; hydraulic oil accounted for 26 percent; and gasoline, motor oil and other fuels accounted for five percent. A summary of Logan Airport jet fuel usage and spill records from 1990 to 2011, and greater detail pertaining to type and quantity of the spills can be found in *Appendix J, Water Quality/Environmental Compliance and Management*.

Table 8-2 Logan Airport Oil and Hazardous Material Spills[1] and Jet Fuel Handling

Year	Total Number of all Spills	Total Number of all Spills >10 gallons	Total Volume of all Spills (Gallons)	Estimated Volume of Jet Fuel Handled (Gallons)	Total Volume of Jet Fuel Spilled (Gallons)
2004	126	18	894	373,996,141	574
2005	97	15	2,319	368,645,932	585
2006	92	11	752	364,450,864	644
2007	108	7	604	367,585,187	361
2008	99	20	944	345,631,788	662
2009	95	6	1004	327,358,619	915
2010	87	15	476	335,693,997	360
2011	**108**	**12**	**572**	**340,421,373**	**337**

Source: Massport Fire Rescue Department and Massport Environmental Management Department.
Notes: Oil and hazardous material spills and jet fuel handling data from 1990 through 2011 is provided in *Appendix J, Water Quality/Environmental Compliance and Management.*
1 Materials include: jet fuel, hydraulic oil, diesel fuel, gasoline, and other materials such as glycol and paint.

Tank Management Program

Since 1993, Massport has had a Tank Management Program in place that is designed to ensure that all Massport-owned tanks are in regulatory compliance with federal and state tank regulations. From 1993 through 2005, Massport completed six construction phases of storage tank modifications that included removal, replacement, and upgrades to existing tanks and the related piping systems in order to comply with federal and state tank regulations. In 2009, Massport installed a remote tank monitoring system for heating oil underground storage tanks (USTs) to allow for continuous monitoring of inventory levels, as well as leak detection. As a BMP, Massport continues to monitor tank systems and upgrade facilities, as needed.

Massport and its tenant tank owners spent much time and effort in 2011 continuing to comply with new state storage tank regulations.[8] These new regulations transferred jurisdiction of all USTs from the Department of Fire Services (DFS) to MassDEP. Jurisdiction of all aboveground storage tanks (ASTs) with capacity volumes greater than 10,000-gallon remains with the DFS, and those ASTs with less than 10,000-gallons capacity are now under local (Massport Fire Department) jurisdiction. There are three ASTs at Logan Airport with volumes greater than 10,000 gallons; two of these tanks are located in the North Service Area, and contain glycol; and the third tank is located at the Central Heating Plant, and is used for storage of heating oil**.** Compliance with the new tank regulations included the following:

- Responses to ongoing MassDEP audits of third party inspection submittals;
- Re-permitting all ASTs using a newly created Massport Fire Department annual permit;[9] and
- Updating and tracking of AST permit status, using the Massport AST database.

Massport is also implementing a successful tank release prevention strategy, which includes:

- A continuing program of monthly inspections, testing, and minor repairs of all Massport-owned tanks, related piping, and tank monitoring systems. Annual Stage II Vapor Recovery testing in June 2011, of

8 527 Code of Massachusetts Regulations (CMR) 9.00.
9 Although ASTs with a capacity of less than 10,000-gallons is no longer under the jurisdiction of the Massachusetts DFS, the ASTs are still subject to the Massachusetts fire regulations and therefore must obtain an annual permit through the Massport Fire Department which has jurisdiction over the less than 10,000-gallon ASTs. ASTs with capacity of over 10,000 gallons also need to obtain this annual permit before those tank owners may obtain a permit from DFS.

Massport's USTs and piping systems at four facility locations. Stage II Vapor Recovery Systems collect gasoline vapors from vehicles' fuel tanks when customers dispense gasoline products into their vehicles at gasoline dispensing facilities. The Stage II system uses special nozzles and coaxial hoses at each gasoline pump to capture vapors from vehicle fuel tanks during the refueling process and reroute them to the station's storage tank(s). Testing included replacement of defective hoses and/or nozzles, as needed.

- Annual DFS inspections of all three of Massport's ASTs greater than 10,000 gallons in volume.
- Review of all proposed tenant tank upgrades, installations, and tank removals (under Massport's Tenant Alteration Application process) to ensure compliance with applicable state and federal regulations and with Massport policy.
- Ongoing upgrade and maintenance of a database that contains information on all USTs located on Massport property. For each tank, the database tracks location, permit status, compliance status with applicable tank regulations, and tank and monitoring system equipment summaries. Information on ASTs is kept in a separate database which was developed in 2010.
- Massport also provides tenants with information regarding the revised storage tank regulatory requirements and offers assistance with tenants' tank permitting procedures.

Site Assessment and Remediation

The MCP (310 Code of Massachusetts Regulations 40.0000), which is administered by the MassDEP, pertains to releases of oil or hazardous materials into the environment. The MCP prescribes the site cleanup process based on the nature and extent of a release's contamination. The MCP defines the roles for those parties affected by and potentially responsible for the release and establishes the release reporting program and submission deadlines for tracking events from initial release to regulatory closure.

In accordance with the MCP, Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. There are a number of phases for the investigation of contaminated sites. Phase I involves initial site investigations for the presence of contamination and Phase II assessments are more comprehensive site investigations. Phase III identifies, evaluates, and selects remediation actions and Phase IV involves the implementation of selected remedial actions. Phase V involves the operation, maintenance and/or monitoring of the remediation program. Massport leads the performance of a variety of response actions, including remediation at sites where Massport is the responsible party, where there are multiple responsible parties, and where no responsible party has been identified.

Table 8-3 describes Massport's progress in 2011 in achieving regulatory closure of the MCP sites identified in Figure 8-2.

Table 8-3 MCP Activities Status of Massport Sites at Logan Airport	
Location (Release Tracking Number) and MassDEP Reporting Status	**Action/Status**
1. Fuel Distribution System (3-1287)	
Phase II Report filed in April 1997	Indicated fuel floating on the groundwater table in 10 discrete locations in the terminal areas; cleanup required to achieve regulatory closure.
Phase III Report filed in April 1997	Reported product recovery as the preferred cleanup alternative; none of the areas to be cleaned up by a responsible party (i.e., a tenant responsible for the contamination). Cleanup was anticipated to span a minimum of three years.
Phase IV Remedy Implementation Plan filed in March 1998	The plan described seven discrete locations of separate phase hydrocarbons (SPH) (jet fuel floating on the groundwater) to be remediated at Terminals C and E as well as three discrete areas at Terminal B to be remediated by tenants who were responsible for the historical release. The remediation strategies that Massport undertook at the seven areas differed depending on the product thickness. Strategies included trench-based product recovery, multi-phase extraction, excavation, and dewatering during construction, and passive remediation.
Phase V Inspection and Monitoring Status Reports filed in September 1998, March 1999, and October 1999	The Status Reports documented remedial actions at seven areas including passive recovery of SPH at Areas 1, 6, and 7, and pumping to recover SPH at Area 3. Interim passive recovery was also implemented at Areas 2 and 4, pending the evaluation of active recovery systems. Remedial objective of less than 1/2 inch of product has been met at Areas 1, 2, 5, 6, and 7, but monitoring continues. MCP closure will be achieved at these areas by applying for an AUL.
Tier II Extension Request submitted in March 2000	Site Closure was not achieved by the March 2000 deadline. A Tier II Extension Request was submitted, providing a plan for continued SPH recovery and monitoring until the remedial objective has been accomplished.
Response Action Outcome (RAO) Submitted March 2001	Under the Class C RAO, monitoring continues at this location along the fuel line for the presence of SPH.
Tier II Extension Request Submitted in July 2002	The Tier II Extension Request and RAM Plan were submitted prior to construction of the Baggage Screening Project in the area of the Fuel Distribution System.
2003	Massport submitted status reports detailing fuel recovery efforts along the distribution system.
2004	Massport submitted status reports to MassDEP detailing fuel recovery efforts along the distribution system in March and September 2004.
2005	Inspection and Monitoring Status Reports were submitted to the MassDEP in March 2005 and March 2006 detailing monitoring and product recovery efforts along the fuel distribution system during the period between September 2004 and September 2005.
2006	An Inspection and Monitoring Status Report was submitted to the MassDEP detailing monitoring and product recovery efforts along the Fuel Distribution System (FDS) between March and September 2006. Massport continues to review data for tightness testing of the fuel line, and completed leak testing of fuel hydrants pits adjacent to Terminal B and Terminal C. Massport continues to meet with BOSFUEL the operator of the FDS, to assess conditions along the FDS at Terminal B and Terminal C, referred to as the Retained Facilities portion of the FDS, and to coordinate the replacement of the Retained Facilities.

Table 8-3 MCP Activities Status of Massport Sites at Logan Airport (Continued)	
Location (Release Tracking Number) and MassDEP Reporting Status	**Action/Status**
1. Fuel Distribution System (3-1287) (continued)	
2007	Inspection and Monitoring Status Reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2006 and September 2007. A Periodic Evaluation Report was submitted in January 2008 which indicated that a Condition of No Substantial Hazard existed at the FDS and a permanent solution was not currently feasible. Massport coordinated with BOSFUEL who prepared construction documents for replacing a portion of the FDS. Construction was conducted under a RAM Plan.
2008	Inspection and monitoring reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2007 and September 2008. Massport coordinated with BOSFUEL during construction to replace a portion of the FDS. The work was conducted under a RAM Plan that was submitted to the MassDEP in May 2008. A RAM Status Report was submitted in September 2008. Construction of the pipeline replacement was approximately 90 percent complete.
2009	Inspection and monitoring reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2008 and December 2009. The BOSFUEL project to replace a portion of the FDS continued, with work being completed on pipeline connections, testing of the new fuel line, and abandonment of the old fuel line. RAM Status Reports for the BOSFUEL Project were submitted in February and September 2009.
2010	Inspection and monitoring reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2009 and September 2010. A RAM Completion Report for the BOSFUEL Project was submitted in February, and the report was revised in March 2010.
2011	*A Periodic Review of the Temporary Solution for the FDS was submitted in April 2011. Additionally, three Post-Class C RAO Status Reports were submitted for the FDS in February, June, and December 2011, summarizing the routine inspection and monitoring activities.*
2. North Outfall (3-4837)	
Phase II and Phase III Reports filed in March 1997	Indicated petroleum contamination present at the site was likely the result of decades of airport operation; risk assessment reported no significant risk to human health, or to the aquatic and avian community.
RAO submitted in March 1998	Class C RAO using a Temporary Solution (periodic site monitoring and assessment); remediation steps included (not limited to) installation of a new fuel distribution system and decommissioning of certain fuel lines, and natural biodegradation processes; goal is to have petroleum contamination reduced to an area less than 1,000 square feet. Installation of the new fuel distribution system and decommissioning of sections of the old system were completed.
	Massport initiated site evaluation to document the reduction of petroleum contamination following the decommissioning of the North Fuel Farm and fuel distribution system.
Post Class C RAO evaluation report submitted in December 2002	Massport has eliminated substantial hazards at this site and submitted a Class C RAO statement. In accordance with applicable regulations, Massport will conduct a periodic evaluation at five-year intervals until a Permanent Solution has been achieved. The next periodic evaluation was scheduled for 2007.
2004	Evaluation report indicated that a “Condition of No Significant Risk” has not been achieved at this site. Massport scheduled another assessment in 2007.

Table 8-3 MCP Activities Status of Massport Sites at Logan Airport (Continued)	
Location (Release Tracking Number) and MassDEP Reporting Status	**Action/Status**
2. North Outfall (3-4837) (continued)	
2005	No change in status for 2005.
2006	Massport prepared the five-year review of the Class C RAO for this site, which was due in December 2007.
2007	Massport completed its five-year review of the Class C RAO and transmitted it to MassDEP in December 2007. It was determined that a “Condition of No Significant Risk” has not been achieved at this site at this time. The next five-year re-evaluation will be conducted in 2012.
2008	No change in status.
2009	No change in status.
2010	No change in status.
2011	*No change in status. Massport provided updated data for the MassDEP website.*
3. Former Robie Park (3-10027)	
2005	A Phase I was completed in 2005 with an RAO retraction. The RAO had been completed by the former property owner.
2006	No change in status for 2006.
2007	No change in status for 2007.
2008	A Phase II Scope of Work was prepared on May 9, 2008. A RAM Plan was submitted to MassDEP on September 16, 2008.
2009	A Phase V Remedy Operation Status Plan was submitted on March 31, 2010.
2010	Two Remedy Operation Status Reports were submitted on September 29, 2010 and March 28, 2011. The next status report was scheduled for September 30, 2011.
2011	*Phase IV Project Status Reports 3 and 4 were submitted in March and September 2011, respectively.*
4. Former Robie Property (3-23493)	
2005	A Phase I was completed in 2005.
2006	No change in status for 2006.
2007	No change in status for 2007.
2008	A Phase II was submitted to MassDEP on October 21, 2008.
2009	An Activity and Use Limitation (AUL) was recorded with the Suffolk County Registry of Deeds for the site on December 16, 2009.
2010	A Class A-3 RAO was submitted on January 4, 2010, corresponding with the recording of an AUL. On May 21, 2010, a RAM Plan for the Economy Parking Structure was submitted. The first RAM Status Report was submitted on September 21, 2010. An AUL Amendment was recorded on December 9, 2010.
2011	*A RAM Completion Statement was submitted on March 15, 2011. Regulatory closure has been achieved. No further response actions are required.*

Table 8-3 MCP Activities Status of Massport Sites at Logan Airport (Continued)	
Location (Release Tracking Number) and MassDEP Reporting Status	**Action/Status**
5. Tomahawk Drive (3-27068)	
2007	Release notification form submitted in August 2007.
2008	A Class B-1 RAO was submitted to MassDEP on January 9, 2009. No further response actions were required.
2009	No further response actions were required.
2010	No further response actions were required.
2011	*No further response actions required.*
6. Fire Training Facility (3-28199)	
2008	Oral notification of release was provided to MassDEP/BWSC on December 10, 2008
2009	A Phase I/Tier classification was submitted on December 17, 2009.
2010	A RAM Plan was submitted to MassDEP on August 6, 2010. A RAM Status Report was submitted to MassDEP on December 3, 2010.
2011	*A RAM Completion Statement was submitted on April 25, 2011.*
	A Phase II Scope of Work was prepared and submitted to MassDEP on January 18, 2011. *Phase II and Phase III Reports were submitted on December 8, 2011. A RAM Completion Statement was submitted on April 25, 2011.*
7. Southwest Service Area (3-28792)	
2009	Release notification form was submitted to MassDEP/BWSC on October 8, 2009.
2010	A Class B-1 RAO was submitted to MassDEP on October 18, 2010. No further response actions required.
2011	*No further response actions required.*
8. Airfield Duct Bank Site (3-29716)	
2010	Release notification form was submitted on December 22, 2010.
2011	*A Class A-1 RAO was submitted on December 23, 2011. No further response actions required.*
9. West Outfall Release (3-29792) *2011*	*Release notification form was submitted on April 8, 2011. Two IRA Status Reports were submitted to MassDEP on June 9 and December 5, 2011. An RAO was submitted on February 13, 2012. No further response actions required.*
10. Hertz Parking Lot Site (3-30260) *2011*	*Release notification form was submitted on August 29, 2011.* *A RAM Plan was submitted to MassDEP on September 1, 2011.*

Source: Massport

Notes: This list includes Massport MCP sites only. Additional sites are the responsibility of Logan Airport tenants. Refer to Figure 8-2 for location of MCP sites.

AUL	Activity and Use Limitation	Phase I	Initial Site Investigation
MCP	Massachusetts Contingency Plan	Phase II	Comprehensive Site Assessment
RAM	Release Abatement Measure	Phase III	Identification, Evaluation, and Selection of Comprehensive Remedial Actions
RAO	Response Action Outcome	Phase IV	Implementation of Selected Remediation Action
SPH	Separate Phase Hydrocarbon	Phase V	Operation, Maintenance and/or Monitoring
FDS	Fuel Distribution System		
ROS	Remedy Operation Status		
IRA	Immediate Response Action		

Figure 8-2 Massachusetts Contingency Plan Sites

Note: Refer to Table 8-3 for the numbered projects.

Environmental Compliance and Management

Massport works to minimize environmental impacts at Logan Airport through ongoing programs and new initiatives. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles.

> *"Massachusetts Port Authority (Massport) is committed to operate all of its facilities in an environmentally sound and responsible manner. Massport will strive to minimize the impact of its operations on the environment through the continuous improvement of its environmental performance and the implementation of pollution prevention measures, both to the extent feasible and practicable in a manner that is consistent with Massport's overall mission and goals."*

Massport's overall environmental compliance and management efforts address the following goals:

- Protect water quality Airport-wide;
- Protect groundwater resources;
- Protect surface water resources (Boston Harbor);
- Minimize air quality impacts;
- Protect resources during construction;
- Mitigate construction impacts;
- Reduce occurrences of fuel leaks and spills; and
- Preserve coastal resources adjacent to the Airport.

The progress report for environmental compliance and management in Table 8-4 summarizes Massport's mechanisms for implementing these goals and details where changes to these efforts occurred in 2011.

Table 8-4 Progress Report for Environmental Compliance and Management

Plan Elements	Progress Report for 2011
Environmental Compliance Inspections	In 2011, Massport performed tenant inspections at a number of its National Pollutant Discharge Elimination System (NPDES) co-permittees' (Logan Airport tenants) leaseholds and made recommendations suggesting how to rectify issues identified during the inspections.
Environmental Management System (EMS) and International Organization for Standardization (ISO) 14001	ISO 14001 certification began for Facilities II (vehicle maintenance, landscaping, and snow removal) in December 2006. Recertification of Facilities II was obtained in December 2009. In 2010, Massport began the process of expanding the Logan Airport EMS to include Facilities I (Central Heating and Cooling Plant), Facilities II and Facilities III (Electrical and Structural). A certification audit of the expanded Logan Airport EMS took place in early June 2011, and a certificate was issued in July 2011. The current Logan Airport EMS covers Facilities I (Central Heating and Cooling Plant), Facilities II (vehicle maintenance, landscaping, and snow removal), and Facilities III (Electrical and Structural).
Tenant Technical Assistance	Massport continued publication of *EnviroNews*, a quarterly newsletter that informs tenants of regulatory calendar milestones, permitting requirements, pollution prevention, and best management practices (BMPs). It recommends use of sustainable materials and provides information on Massport and other environmental requirements (2011 newsletters are provided in *Appendix J, Water Quality/Environmental Compliance and Management)*.

Table 8-4 Progress Report for Environmental Compliance and Management (Continued)	
Plan Elements	**Progress Report for 2011**
Stormwater Pollution Prevention Plan (SWPPP)	In accordance with the requirements of the current stormwater outfall NPDES permit for Logan Airport that was issued on July 31, 2007, Massport and 25 other co-permittees were required to develop SWPPPs. Massport completed its SWPPP in December of 2007. Tenant SWPPPs were completed in March 2008. Massport's SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemicals, potential bacteria, fuel and oil, and other sources of stormwater pollutants. BMPs are included in the SWPPP. In accordance the other requirements of the NPDES permit, Massport is required to conduct training for personnel responsible for implementing activities identified in the SWPPP. The 2011 Annual Certificates of Compliance were submitted to EPA and MassDEP in December 2011 for Massport and each of its co-permittees.
Construction	Massport developed Sustainable Design Standards and Guidelines (SDSG) for use by architects, engineers, and planners who manage capital improvement projects for Massport (More information on SDSG is provided in *Chapter 1, Introduction/Executive Summary*). The SDSG, first issued in 2009 and revised in 2011, are designed to foster innovation yet include clear targets to achieve more sustainable project design and practices. The SDSG are intended to evolve over time, based on changes in technologies and industries. *Chapter 1, Introduction/Executive Summary* contains additional information on the SDSG. Massport provides a generic SWPPP to contractors for all Logan Airport construction projects, which provides guidance in preparing project-specific SWPPPs and BMPs to control sedimentation and other pollutants from construction projects. Massport monitors construction projects at Logan Airport for compliance with project SWPPPs and regulatory requirements. For all construction projects, Massport requires the use of ultra-low-sulfur diesel fuel in construction equipment, recycling of all construction waste to the maximum extent possible, and construction equipment retrofits with pollution control devices such as diesel oxidation catalysts and/or particulate filters.
Spill Prevention Control and Countermeasure (SPCC) Plans	Tenants meeting certain thresholds are required to prepare their own SPCC plans for their facilities. Massport checks for SPCC plans during its environmental compliance inspections. Additionally, tenants receive information on Massport BMPs, which focus on spill management and prevention.
Air Emissions Reduction	All Massport diesel vehicles are now fueled with ultra-low-sulfur diesel. In 2007, Massport investigated the use of parking heaters, which operate independently of a vehicle's engine, in order to measure fuel savings/air emissions reductions of reduced vehicle idling during snow operations. The investigation was discontinued in 2008 after Massport found that the parking heaters resulted in draining vehicle batteries. Massport will continue to explore anti-idling technologies as part of the EMS.

Source: Massport

Clean State Initiative and Leading By Example Program

- On April 18, 2007, the Governor signed Executive Order 484, establishing the Leading by Example – Clean Energy and Efficient Buildings Program (known as the Leading by Example Program).[10] Executive Order 484 supersedes Executive Order 438 which established Massachusetts' former Sustainability Program. The Leading by Example Program was created to help state agencies minimize the environmental impacts of their operations and activities and to promote innovative solutions to critical environmental problems. The Executive Order sets aggressive targets for state facilities in greenhouse gas emission reductions, energy conservation and efficiency, renewable energy, green buildings, and water conservation. Massport participates in this program voluntarily.
- As of 2009, Massport resolved all outstanding environmental matters of the Clean State Initiative, which was established under Executive Order 350.[11] The Clean State Initiative was established to ensure that all state agencies are aware of and are in compliance with the environmental laws of the Commonwealth. Massport worked to identify, evaluate, and correct matters of environmental noncompliance, which included re-plumbing of stormwater/sanitary piping work in the Terminal B garage in 2009. No other noncompliance issues have been identified.
- In 2009, Massport began developing an Energy Master Plan to reduce energy use and associated greenhouse gas emissions and increase the use of renewable energy for all Massport facilities. Further details on the Energy Master Plan are provided in *Chapter 7, Air Quality/Emissions Reduction.*

10 Governor Deval Patrick, Commonwealth of Massachusetts. Executive Order 484, Leading by Example – Clean Energy and Efficient Buildings. April 18, 2007. Available: http://www.mass.gov/governor/legislationeexecorder/executiveorder/executive-order-no-484.html.

11 Governor William Weld. Commonwealth of Massachusetts. Executive Order 350, Massachusetts Statewide Environmental Coordinating Council. February 3, 1993. Available: http://www.lawlib.state.ma.us/source/mass/eo/eotext/EO350.txt.

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9

Project Mitigation Tracking

Introduction

This *2011 Environmental Status and Planning Report (2011 ESPR)* provides an update on the Massachusetts Port Authority's (Massport) mitigation commitments under the Massachusetts Environmental Policy Act (MEPA) for Logan Airport projects where an Environmental Impact Report (EIR) was filed. Each of the projects completed the state and federal environmental review processes and adopted a mitigation plan that has been formalized with individual Section 61 Findings.[1] Massport tracks both Massport and Logan Airport tenants' progress toward implementing and achieving their environmental mitigation commitments on schedule and according to the requirements set out in the Section 61 Findings for each project. As each project moves forward through its design and construction phases, its mitigation plan is implemented with ongoing tracking to ensure compliance. This chapter provides Section 61 mitigation commitment updates in 2011 for projects for which mitigation is ongoing or upcoming (Tables 9-1 through 9-7). Projects for which mitigation has been completed are not reported on in Environmental Data Reports (EDRs) and ESPRs. For projects with ongoing requirements, once those projects are constructed, mitigation tracking will report only on the continuing requirements.

Projects with Ongoing Mitigation

- **West Garage Project**, Executive Office of Environmental Affairs (EOEA, now Executive Office of Energy and Environmental Affairs (EOEEA)) #9790 (Phase I complete. Phase II construction was completed in early 2007). The status of continuing requirements is documented.
- **International Gateway Project**, EOEA #9791 (Phase I was completed in 2004; Phase II was completed in 2007; the final phase is not expected to be completed before 2015). The status of continuing requirements for Phases I and II is documented.
- **Replacement Terminal A Project**, EOEA #12096 (Terminal A opened March 16, 2005). The status of continuing requirements is documented.
- **Logan Airside Improvements Planning Project**, EOEA #10458 (Runway 14-32 opened on November 23, 2006. The Centerfield Taxiway was completed and became fully operational in 2009). The status of continuing requirements is documented.

1 Massachusetts General Law, Chapter 30, Section 61 (M.G.L. c. 30, § 61).

- **Southwest Service Area (SWSA) Redevelopment Program**, EEA #14137; on May 28, 2010, the Secretary of EOEEA issued a Certificate that determined that the Final EIR adequately and properly complied with MEPA and its implementing regulations. Massport's Board approved the Section 61 Findings for the SWSA Redevelopment Program on June 17, 2010. Construction of the program commenced in summer of 2010 and will be complete by 2014. The status of ongoing requirements is documented.

Recently Approved Project with Mitigation Conditions/Requirements

- **Logan Airport Runway Safety Areas (RSA) Project**, EEA #14442; on March 18, 2011, the Secretary of EOEEA issued a Certificate that determined that the Final Environmental Assessment (EA)/EIR adequately and properly complied with MEPA and its implementing regulations. Construction on the Runway 33L RSA began in June 2011 and was completed in November 2012. The replacement of the Runway 33L approach light pier was completed concurrently with Runway 33L RSA construction. Construction of the Runway 22R Inclined Safety Area (ISA) is not scheduled to begin until 2014. The status of the Runway 33L RSA enhancement project ongoing requirements is documented. Both project elements will be complete by the end of 2015.

Projects with Section 61 Mitigation

West Garage Project – EOEA #9790

Permitting History

- Certificate on the Final EIR issued on March 16, 1995
- Section 61 Findings approved on March 27, 1995

Project Status

The West Garage Project (Figure 9-1) was initially proposed to be constructed in two phases. Phase I of the Project provided 3,150 parking spaces that were consolidated from other areas of Logan Airport. The West Garage is directly connected to the Central Garage, centralizing the two structures' parking into a larger, single functioning, easily accessible garage. The West Garage Project also included construction of elevated walkways connecting the West Garage to Terminals A and E, and improvements to the terminal roadways. The original design of Phase II of the West Garage included the construction of a new structured parking facility adjacent to the West Garage. Instead, Massport concluded it was more cost efficient to proceed with Phase II by adding three additional levels (Levels 5, 6, and 7) to the existing Central Garage. Phase II of the West Garage Project provided approximately 2,800 additional parking spaces.

- Phase I – Construction commenced in October 1995 and the garage opened on September 8, 1998. The elevated walkways to the terminals were completed in 2002. Improvements to terminal roadways were completed in 2003.
- Phase II – Permitting completed in 2000 to add three levels to the Central Garage. Construction commenced in 2004 and the entire facility was completed in 2007.

Table 9-1 lists each of the continuing Section 61 mitigation commitment for the West Garage Project and Massport's progress in achieving these measures. Table 9-2 details the elements and status of the Alternative Fuels Program, which was a key mitigation effort associated with the West Garage Project. The mitigation measures in Tables 9-1 and 9-2 are from Section IV Mitigation of the *West Garage Project Final EIR*, January 31, 1995, and those measures referenced in the Massport Board vote on the West Garage Project. Many of the

mitigation measures for this project have long since been implemented but it is noted in the tables when there have been recent updates.

Figure 9-1 West Garage Project

Phase I West Garage Construction
Phase II Addition to Central Garage

Table 9-1 West Garage Project Status Report (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011)

Mitigation Measure	Status
Parking Pricing	
Parking pricing initiatives: keeping first-hour price high enough to provide a disincentive for pick-up/ drop-off.	**Implemented.** Massport continues to evaluate and adjust the first-hour price of parking. In light of the security prohibition on curbside parking, in 2002, Massport reduced the cost of the first half-hour from $4 to $2, the first time it had changed since the first-hour free rate was rescinded in 1998. In June 2007, rates increased to $3 for the first half-hour. Parking rates increased in March 2012 for on-Airport parking; further details on parking rate increases are provided in Table 5-6 of *Chapter 5, Ground Access to and from Logan Airport.*
Parking pricing initiatives: keeping the weekly price low enough to encourage vacation travelers to park for a week.	**Implemented.** Massport encourages long-term parking by providing lower cost parking at its Economy Lot. Data on long-term parking use are provided in *Chapter 5, Ground Access to and from Logan Airport.*
Massport will consider means to encourage the use of limited amount of on-Airport commercial parking for long-term parking and promote environmentally positive modes of airport access by air passengers.	**Implemented.** An important element of Massport's strategy to reduce the impact of Airport-related traffic on regional highways and local streets in neighboring communities is the Massport Parking Pricing Policy. Historically, Massport's Parking Pricing Policy encouraged long-term parking over short-term parking. That was accomplished by charging a premium for time spent in the on-Airport parking facilities between one and four hours and substantially reducing the per hour rate for parking durations longer than four hours. This strategy has proved to be a successful incentive for passengers to drive themselves and park long-term at Logan Airport rather than having someone else drop them off or pick them up. As described in *Chapter 5, Ground Access to and from Logan Airport*, parking exits have decreased as a result of longer terms stays.
Once sufficient data has been collected, Massport will evaluate parking behavior that may be attributable to the modified rates and consider further adjustments in pricing that will assist in achieving Massport's ground transportation goals.	**Implemented.** Massport's parking rate structure is compatible with continued growth in long-term parking, and the continued goal to increase the total high occupancy vehicle (HOV) use by air passengers toward 35.2 percent HOV access mode share. Adjustments to hourly parking rates have been made over time to reflect usage patterns.
Executive Director shall report to Massport annually regarding the effectiveness of parking pricing policy in achieving Massport's ground access goals initiatives and recommend appropriate policy adjustments.	**Implemented.** In October 2001, the Massport Board granted approval of commercial parking rates consistent with Massport's ground access goals. The higher rates went into effect November 12, 2001. In addition, in light of the new security restrictions on curbside parking, Massport reduced the cost of parking for the first half-hour from $4 to $2. In June, 2007, the cost of parking for the first half-hour increased to $3. These modifications foster the use of alternate forms of transportation for getting to Logan Airport, whereas the weekly cap at Economy Parking encourages long-term parking over pick-up and drop-off as a mode of access. Please refer to *Chapter 5, Ground Access to and from Logan Airport*, for additional details on Massport's parking pricing efforts.

Table 9-1 West Garage Project Status Report (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011) (Continued)

Mitigation Measure	Status
Concurrent Ground Access Improvement Mitigation Measures	
Employee Trip Reduction Measures	
Massport will form a Transportation Management Association (Logan TMA) for Logan Airport employees to provide new opportunities for the development of targeted transportation demand management (TDM) strategies for Massport and airport tenant employees.	**Implemented.** In the 1995 Board Resolution, Massport's Executive Director was authorized to expend an initial amount of up to $50,000 for the purpose of organizing the Logan TMA. The Logan TMA was created in March 1997. Currently the Logan TMA is managed by Massachusetts Department of Transportation (MassDOT) through its MassRides program (www.commute.com). Massport continues to support the Logan TDM strategies by funding the Logan Sunrise Shuttle at an annual cost of $65,000. In turn, MassRides has a Logan TMA Coordinator who develops coordinates, and implements TDM strategies.
Massport will seek to develop, coordinate, and implement effective TDM strategies to reduce the number of single-occupant trips made by all Logan Airport employees.	**Implemented.** Massport continues to work with the MassDOT (which provides the Logan TMA coordinator position through its MassRIDES program) to support the Logan TMA. The 1995 Board Resolution authorized Massport to actively explore with the Logan TMA the feasibility of implementing various services. Massport assists the Logan TMA in providing services and by periodically conducting the Logan Airport Employee Survey (a survey was conducted in 2010). Results of the 2010 survey are summarized in *Chapter 5, Ground Access to and from Logan Airport.*
Massport will encourage participation by all employees, but will particularly target the airport's largest employers.	**Implemented.** Massport continues to target Logan Airport's largest employers. Refer to *Chapter 5, Ground Access to and from Logan Airport* for more details on the Logan TMA and its membership.
Massport will report on the formation and activities of the Logan TMA in the next Generic Environmental Impact Report (GEIR).	**Implemented.** The Environmental Status and Planning Reports (ESPRs) and Environmental Data Reports (EDRs) provide information on the Logan TMA, its services, membership, and employee commuter choices (via the Logan Airport Employee Survey). Information on Logan TMA is summarized in *Chapter 5, Ground Access to and from Logan Airport.*
Massport proposes to implement a new Logan Express service or other HOV service depending on the needs of the targeted market before Phase II of the West Garage Project is operational.	**Implemented.** The Peabody Logan Express facility opened in September 2001 (See *Chapter 5, Ground Access to and from Logan Airport* for additional information on Peabody Logan Express). Despite low ridership, Massport continues to operate this service.

**Table 9-1 West Garage Project Status Report (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011) (Continued)**

Mitigation Measure	Mitigation Measure
Provide an airport shuttle service from South Station Transportation Center. Massport is preparing a feasibility and business plan for a South Station-Logan Airport shuttle service and will implement this service when the Third Harbor Tunnel is opened for commercial traffic. This service will be modeled on the existing, successful Logan Express services and will include frequent bus service between South Station and the airport terminals.	**Implemented.** In 1997, Massport sponsored the development of a joint public/private partnership with intercity bus operators serving the South Station Transportation Center. This partnership resulted in a bus connection that both the carriers and Massport promote. The service had limited success largely because of variable operator schedules and the fact that the service operates out of the South Station Transportation Center instead of a location closer to the South Station Red Line stop. Following the interim Logan DART service between Logan Airport and South Station in 2000 and coordination of other available bus services, in June 2005, Massport and the Massachusetts Bay Transportation Authority (MBTA) jointly commenced full Silver Line Airport Service providing a direct connection between South Station and each Logan Airport terminal. Refer to *Chapter 5, Ground Access to and from Logan Airport* for additional information on the Silver Line.
Massport will regularly evaluate the frequency of, and demand for, such shuttle service and will provide such service at the greatest frequency that is practical and effective.	**Implemented.** Massport continues regular collaboration with MBTA on the Silver Line Airport Service and makes adjustments as necessary. Since May 2012, Massport has sponsored a pilot program offering free rides on the Silver Line from Logan Airport to downtown Boston to promote HOV usage and heighten awareness of public transit options. The purpose of the pilot program is to promote ridership, operations, and customer service. Free service will continue through June 1, 2013.
Massport will implement a new water shuttle service in Boston Harbor before the opening of Phase I of the West Garage Project. The water shuttle would run between Logan Airport and one, or possibly, more sites in the Harbor.	**Implemented.** Massport identified a number of possible destinations for a new water shuttle service, with the Quincy Shipyard and Long Wharf sites meeting the basic service parameters. Harbor Express was chosen as the water shuttle operator and began operation between the Airport and these two sites in November 1996. Massport continues to support the Rowes Wharf Water Taxi and City Water Taxi operations. Refer to *Chapter 5, Ground Access to and from Logan Airport* for water shuttle ridership information.
The Executive Director shall make recommendations to Massport for budgetary appropriations to establish and implement the new ground access services on a schedule that permits Massport to implement the new ground access services within these time frames.	**Implemented.** The Executive Director/CEO recommends budgetary appropriations for ground access services on an annual basis.
Enhancement of Existing HOV Services: Logan Express	
Expand Logan Express hours of service.	**Implemented.** Service is offered from Braintree as early as 3:00 AM and as late as 11:00PM; from Framingham as early as 3:15 AM and as late as 11:00 PM; from Woburn as early as 3:00 AM and as late as 11:00 PM; and from Peabody as early as 3:15 AM and as late as 10:45 PM. Buses leave every hour or half hour. Logan Express buses now depart from Logan Airport as late at 1:15 AM. The Logan Express schedule is available at www.massport.com.
Provide a guaranteed ride home for Logan Express users.	**Implemented and subsequently modified.** From January 1995 until November 2001, Massport provided this service for air passengers and Logan TMA members. Due to financial constraints following September 11, 2001, this program was suspended for those passengers arriving after midnight with pre-purchased round-trip Logan Express tickets. Logan TMA members still benefit from this service through MassRides.

**Table 9-1 West Garage Project Status Report (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011) (Continued)**

Mitigation Measure	Mitigation Measure
Provide Logan Express price incentives.	**Implemented.** Massport continues to monitor price incentives and implements additional incentives to promote Logan Express ridership, particularly during vacation periods and other periods of peak airport activity. In April 2011, Logan Express sites offered a discounted rate for parking. A survey of Logan Express passengers revealed that drop off activity at Logan Airport was reduced and the demand for parking at Logan Airport was reduced during the period of the discounted Logan Express parking. To encourage greater ridership, Massport restructured parking rates, which lowered parking rates to $7 per day from $11 per day at Logan Express parking lots. These rates went into effect on March 1, 2012 (and have resulted in increased Logan Express passenger activity at rates greater than the increase in Logan Airport air passengers). Further pricing incentives are under consideration.
Develop an additional Logan Express service.	**Implemented.** Massport opened a fourth Logan Express in Peabody, Massachusetts in September 2001, several years before the Section 61 Commitment date of the opening of Phase II of the West Garage Project. While the new service was initially planned to operate on a half-hour schedule like the Braintree, Framingham, and Woburn services, because of the dramatic air passenger reductions after September 11, 2001, (during Peabody's first week of service), to cut costs, Massport operated the Peabody Logan Express on hourly headways. In January 2004, in light of low levels of ridership on the Peabody Logan Express, Massport doubled service by going to a half-hourly schedule in an effort to stimulate ridership growth at Peabody. The service now operates on an hourly weekday schedule. In 2011, annual ridership levels were approximately 57,296 at Peabody, 519,036 at Braintree, 340,529 at Framingham, and 269,261 at Woburn.
Enhancement of Existing HOV Services: Water Transportation	
In conjunction with the MBTA, Massport will pursue joint ticketing opportunities for the Hingham Commuter Boat and the Logan Airport Water Shuttle.	**Implemented.** This ticketing program was explored, implemented in mid-1995 and discontinued in 2000 since many of the former users of this program now use the Harbor Express Service direct from Quincy to Logan Airport.
Massport is reviewing the fee schedules and operating requirements of the dock in order to make it more accessible and convenient to potential water taxi operators.	**Implemented.** In the fall of 1995, Massport made physical improvements to a low-freeboard float at the Logan Dock to create a dock capable of accommodating smaller vessels such as water taxis. In the fall of 2002, Massport completed expansion of the Harborside dock to accommodate the demand of additional vessels and to comply with handicapped accessibility requirements. The improved dock increases capacity from a two float system to a seven float system to accommodate the various water shuttles, taxis, and charter boats that are licensed to use it.
Initiate a new Boston Harbor Water shuttle service.	**Implemented.** Harbor Express service, between Logan Airport and the South Shore, began in November 1996, well before the opening of Phase I of the West Garage in September 1998. In 2001, the MBTA took over operations of this service.
Expand docking capacity at Logan Airport for water taxi and other services.	**Implemented.** Massport accommodates water taxi services, enhanced the dock as described above, provides communication links for passengers to call the taxi, and allows taxi passengers to use the free water shuttle buses to access the terminals from the dock. Water taxi information is posted on the Massport website. Details on the Water Taxi are provided in *Chapter 5, Ground Access to and from Logan Airport*.

**Table 9-1 West Garage Project Status Report (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011) (Continued)**

Mitigation Measure	Mitigation Measure
Other Measures	
Coordinate with public and private entities to provide more extensive radio, television, and telephone announcements of poor traffic conditions with suggestions for alternative access modes.	**Implemented.** The 1-800-23LOGAN Customer Information Line includes the number of the telephone text information line. Callers to Customer Information Line may access the latest traffic information, flight status, parking information, cell phone waiting lot information, or learn about alternative forms of transportation to and from Logan Airport. Starting in August 1999, real-time traffic information and parking became accessible on Massport's website. Massport regularly contacts the media to inform the public about roadway changes, parking shortages and to encourage travelers to use HOV services. Similar information is disseminated on the Logan Airport e-mail subscriber list, the Massport website, Facebook, and on Twitter at twitter.com/bostonlogan.
HOV Marketing and advertising. Massport will continue the advertising and marketing programs for HOV services with an emphasis on promoting MBTA, Logan Express and water shuttle services to and from the airport.	**Implemented.** Massport spent over $27,000 on marketing of Logan Express in 2011. Massport continues to promote HOV services including availability, schedules and fares to consumers through the ground transportation Information Line at 1-800-23LOGAN and the website that provides up to the minute information. HOV advertising boards, schedules, and maps are placed at all Logan Airport terminals, at the MBTA Airport Station and at all shuttle bus pick-up/drop-off locations. Massport has actively promoted passenger water transportation in Boston Harbor for more than 20 years, playing a leadership role in policy development, planning, and promotions. This has included promoting vessel services at Logan Airport in the following ways: ▪ Annual updates and in-terminal and citywide distribution of a brochure promoting water transportation at Logan Airport; ▪ Annual updates of harbor-wide water transportation map showing routes serving Logan Airport and other routes and landings as well – Massport provides this map to the MBTA, area non-profits, and others interested in promoting passenger water transportation in Boston Harbor; ▪ Updated information promoting passenger water transportation at Logan Airport on 1-800-23-Logan and www.massport.com; ▪ Planning and promotions for kick-off press conference launching the first-ever electric water taxi to operate in Boston Harbor (Green Water Taxi operated by Rowes Wharf Water Transport); and ▪ Collecting, tracking, and disseminating passenger water transportation ridership data for Logan Airport passengers to aid in planning and facility development. Elsewhere in Boston Harbor, Massport prepared final design materials for a new hub water transportation terminal in the South Boston Waterfront which, when built, would serve as a state-of-the-art landing for water taxis and a potential terminus for future Logan Airport-based scheduled vessel routes.

**Table 9-1 West Garage Project Status Report (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011) (Continued)**

Mitigation Measure	Mitigation Measure
Prepare an inventory of private scheduled services including origins/destinations, schedule, and cost.	**Implemented.** Massport continues to update and track information and services by more than 700 privately operated passenger services certified to operate at Logan Airport. Industry changes with such operations make publication of reliable service and schedule information impractical, if not impossible. However, Massport continued to expand and update information on transportation options to Logan Airport using the latest information technologies, including: ▪ Information and links to transportation companies on the Massport website. Some sites accessed through internet links provided passengers with on-line reservation services; ▪ Most scheduled service operators provided placards with current schedules posted in bus stop shelters located on the curb at each terminal. Individual bus schedules were also available at the information booths; and ▪ Transportation information database for on-line assistance at Logan Airport terminal information booths.
Proceed with environmental review and seek funding for construction of People Mover system.	**Implemented.** Massport completed the Environmental Assessment (EA) and Major Investment Study for the Logan Airport Inter-modal Transit Connector (AITC). The AITC evolved out of the People Mover process and evaluated new access routes to both the Blue Line and the South Station Transportation Center. On February 25, 1997, Massport submitted to the U.S. House Committee on Transportation and Infrastructure an application for the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) funds for the next phase of environmental review, planning and design of the AITC. Congressman J. Joseph Moakley was the congressional sponsor; the project also has the support from the Secretary of Transportation and the U.S. Environmental Protection Agency (EPA). The Logan AITC was included, for an unspecified funding level, in the 1997 ISTEA reauthorization bill. In 1998, Massport received a certificate on a Notice of Project Change (NPC) for the People Mover from the Secretary of EOEEA and a Finding of No Significant Impact (FONSI) on an EA from the Federal Transit Authority. In June 2001, Massport and the MBTA executed an interagency agreement for the purchase of eight Silver Line dual mode buses and the Massport Board approved the expenditure of approximately $13 million for this purchase. In 2004, Massport and the MBTA finalized the 10-year/$20 million dollar Inter-Agency Operating & Maintenance Agreement. Initial Silver Line service to the Airport began in December 2004 and full service began in June 2005 (refer to *Chapter 5, Ground Access to and from Logan Airport* for additional details).
Alternative Fuels program. Massport is carrying out an extensive program to convert existing Massport-owned service vehicles to environmentally preferable sources.	**Implemented.** Table 9-2 of this *2011 ESPR* details Massport's progress in achieving these measures.

**Table 9-1 West Garage Project Status Report (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011) (Continued)**

Mitigation Measure	Mitigation Measure
Measuring, Monitoring, and Evaluating Ground Access Improvements	
Massport will assess progress towards the achievement of HOV goals using on-Airport Automated Traffic Monitoring Systems (ATMS).	**Implemented.** Massport has an ATMS plan that provides daily traffic counts at all gateways and other critical locations. Massport uses technologies that utilize on-Airport traffic signal controllers and loops for traffic counting. The Logan ATMS uses technologies that detect vehicle movement: inductive loop lines, and microwave sensors. Upgrades of the ATMS equipment, program software and infrastructure are underway and will result in accurate, meaningful vehicle counts. With the completion of the Terminal Area Roadway system and other regional highways expected in the near future, The project is complete and the upgraded ATMS is functioning as planned and designed.
Massport will assess progress towards the achievement of HOV goals by monitoring parked vehicles using systems such as the parking and revenue control (PARC) system.	**Implemented.** Massport monitors all parking activity at Logan Airport and inventories all commercial parking facilities on a daily basis. Updated PARC systems were installed in the Terminal B Garage in 2004, with Central/West Garage following in 2005. Terminal E and Economy Garage also have PARC systems.
Monitor HOV Services (Logan Express, MBTA, water shuttle, limousine/bus, and taxi).	**Implemented.** Massport maintains a "real time" log of dispatcher reports for Logan Express, the taxi pool, and the bus/limousine pool and other ground transportation operations at Logan Airport. Massport coordinates with the MBTA and the operators of all water shuttles serving Logan Airport to track ridership and service schedules. Daily Logan Express ridership and operations data are submitted monthly to Massport. Massport maintains a Passenger Water Transportation Ridership Summary on a monthly basis. Massport maintains a continuing record, the Ground Transportation Unit (GTU) Daily Event Log, of all occurrences impacting the Airport roadways, terminal curbs, and access roads. This log cites such events as accidents, lane closures, bus delays, as well as routine and non-transportation events.
Monitor passenger activity and employee modes of transportation.	**Implemented.** The most recent employee and air passenger surveys were conducted in the spring of 2010 and are summarized in *Chapter 5, Ground Access to and from Logan Airport* of this *2011 ESPR*. Additional detailed results were provided in the *2010 EDR.* The *2007 EDR* summarized the previous 2007 survey results in *Chapter 5, Ground Access to and from Logan Airport*. Air passenger surveys are used to measure Massport's success in achieving a 35.2 percent HOV mode share by the time Logan Airport accommodates 37.5 million passengers.
Massport supports the use of Automated Vehicle Identification (AVI) to monitor, manage, and facilitate efficient traffic operations at Logan Airport and elsewhere on the regional transportation system.	**Implemented.** An AVI system for Massport's Logan Airport shuttles and Logan Express buses is planned. All new buses are being procured with AVI/global positioning system (GPS), in anticipation of a planned "next bus" arrival notification system. In addition, the consolidated car rental facility (ConRAC) will have an operations room with the required equipment to track the new clean-fuel unified bus fleet.
Track the effectiveness of ground access measures.	**Implemented.** Massport continues to track the effectiveness of its ground access mitigation programs in its annual MEPA filings. See *Chapter 5, Ground Access to and from Logan Airport* for 2011 details.

Source: Massport
Note: Text in italics detailing the mitigation measures is from Section IV, Mitigation of the *West Garage Final EIR*, January 31, 1995.

Table 9-2 describes the Alternative Fuels Program, which was part of the West Garage Section 61 commitments.

Table 9-2 Alternative Fuels Program — Details of Ongoing Section 61 Mitigation Measures for the West Garage Project (as of December 31, 2011)

Program Element	Projected Date of Completion/ Acquisition	Status
Purchase four electric passenger utility vehicles	Winter 1995	**Implemented.**
Purchase five electric sedans	Winter and Summer 1995	**Implemented.**
Build compressed natural gas (CNG) quick-fill station	Spring 1995	**Implemented.** The station has been operational since 1995. It is New England's largest CNG quick fill station and serves Massport's vehicles, over two dozen Airport tenants, and nearby fleet vehicles. New higher flow dispensers at the station have reduced fueling time for heavy-duty vehicles, and have increased storage capacity at the station. Currently, more than a dozen companies and organizations are fueling natural gas powered vehicles at the station. In 2011, the station pumped approximately 41,550 gallon equivalents per month. Additional above-ground storage was also provided.
Purchase five electric buses	Spring and Summer 1995	**Implemented.** Massport purchased two electric buses and leased one. These vehicles operated at Logan Airport between 1996 and 2001. After more than six years of testing and evaluation, Massport determined that electric buses are neither durable nor dependable enough to function effectively in the demanding operating environment at Logan Airport. Massport's new unified bus fleet includes clean diesel/electric hybrid buses. Massport will continue to evaluate electric and other alternative fuel vehicles (AFV) as new technologies become available.
Purchase five electric pick-up trucks	Spring 1995	**Implemented.**
Use soy-blend diesel fuel	Spring 1995	**Implemented.** Massport's shuttle fleet operated on soy diesel from 1995 to 1999. In 1999, all the buses were replaced with CNG buses. This fleet was fully replaced in 2012 by CNG and clean-diesel/electric hybrid buses.
Purchase additional AFVs	Spring 1995	**Implemented.** Refer to *Chapter 7, Air Quality/ Emission Reduction* for a list of AFVs.
Purchase six CNG buses	Summer 1995	**Implemented.** The initial fleet of 26 CNG shuttle buses was fully replaced in 2012 with 32 60-foot clean diesel/electric hybrid buses and 18 42-foot CNG buses.
Purchase four electric vans	Summer 1995	**Implemented.**
Install quick-charge kiosks for electric vehicles	Summer 1995	**Implemented.**
Develop slow-charge infrastructure	Ongoing	**Implemented.** The electric charging infrastructure included 15 inductive charging locations but these are not in use since there are no vehicles currently using inductive charging. In 2012, Massport installed 13 new electric vehicle charging stations to accommodate a total of 26 vehicles in the Central and Terminal B parking areas.

Source: Massport

International Gateway Project (Terminal E) – EOEA #9791

Permitting History:

- Certificate on the Final EIR issued on December 2, 1996
- Section 61 Findings submitted to EOEEA June 26, 1997

Project Status

The International Gateway Project (Figure 9-2) expands and upgrades Terminal E to provide better service to international passengers. The original Terminal E was opened in 1974 and over time became outdated and too small to accommodate the growth in international travel. This project is being constructed in phases:

- **Phase 1 – Complete.** This phase of the project included a weather-protected outside airside bus portico with an elevator and escalator linking the ground floor with the second floor to accommodate passengers arriving on remotely parked aircraft that are unable to park at a gate because it is occupied by another aircraft.
- **Phase 2 – Complete.** This phase of the project enlarged Logan Airport's congested Federal Inspection Services (FIS) Facility, and improved the meeter/greeter lobby and the ticketing area of Terminal E to maximize passenger convenience and reduce processing times in the terminal. The project called for the reconstruction and expansion of Terminal E in and around the existing terminal while keeping it operational and safe. The new departure hall includes high ceilings, wood paneling, built-in artwork, and views of the city skyline. Additionally, to reduce curb and roadway congestion at Terminal E, this project also included a new separated roadway system for arrivals and departures.
- **Future Phase – Pending.** This phase involves the construction of a new West Concourse, which will add three new gates to Terminal E to accommodate wide-body aircraft.

Construction of this project commenced in the summer of 1998. Phase 1 was completed in 2004. The departure level of the new $321 million terminal, including the new ticketing hall and departure level roadway, opened in May 2003. Enlargement of the FIS Facility and construction of the new arrivals level was completed in July 2007. Phase 2 is now complete. Preliminary work was completed for the West Concourse; however, further work is not expected before 2015. Additional information on the status of this project is available in *Chapter 3, Airport Planning.*

Table 9-3 lists each of the continuing mitigation measures for the International Gateway Project in the Section 61 Findings along with Massport's progress in achieving these measures through the end of 2011. Many of the mitigation measures for this project have long since been implemented but it is noted in the tables when there have been recent updates. Completed design and construction phase measures are described in previous EDRs.

Figure 9-2 International Gateway Project

Note: Runway 14-32 construction completed in November, 2006.

Table 9-3 International Gateway Project Status Report (EOEA #9791)
Section 61 Mitigation Measures (as of December 31, 2011)

Mitigation Measure	Status
Alternative Fuel Outreach Program	
Massport is working cooperatively with the EPA and regional utility providers in coordinating an ongoing outreach program aimed at promoting the use of clean-burning alternative fuels. This program, which is also supported by fuel providers, vendors, and state and federal agencies, will offer information to airport tenants in the following areas: ▪ *Notification of grant programs or other financial incentives for vehicle conversions.* ▪ *Assistance in cost-benefit analysis for conversion of conventionally fueled vehicles to AFVs.* ▪ *Assistance in placing airport tenants in contact with alternative fuel suppliers and product vendors.*	**Implemented.** Massport continues to work cooperatively with National Grid, Alternative Vehicle Service Group (AVSG), the City of Boston, and the Massachusetts Clean Cities Coalition to promote the implementation and integration of Alternative Fuel Vehicles (AFVs) into local private and public fleets. In May 2007, Massport adopted two new policies to promote alternative fuel and hybrid vehicle usage at Logan Airport by others: 1) limited front-of-line taxi pool privileges; and 2) preferred Parking locations in the Central Garage and the new Economy Garage. These policies remain in effect. In addition, Massport has supported and financially sponsored the Boston GreenFest since 2009 and AltWheels Fleet Day since 2003. These are annual forums to promote alternative fuels and sustainable transportation modes.
HOV Promotion	
Massport will reserve terminal space for ground transportation ticket sales, reservations, and information.	**Implemented.** This space has been provided in a staffed information area in the arrivals area of the new terminal. In a joint venture with Massachusetts Bay Transportation Authority (MBTA) new Charlie Card automated fare collection equipment was installed in all Logan Airport terminals in 2006. In mid-2012, in an effort to encourage greater transit ridership, Massport commenced a pilot program for free boarding of the Silver Line at Logan Airport through June 1, 2013.
Attractive and distinctive signage and graphics will be utilized inside the terminal and out at the curb to clearly mark access to Logan Express, MBTA, water transportation, and other HOV options.	**Implemented.** Signage has been installed in the terminal and at the curbside identifying high occupancy vehicle (HOV) curb locations. In 2012, Massport installated new digital signage at all terminal Silver Line curb locations to indicate next bus wait times.
As HOV services continue to develop and expand at Terminal E, Massport will expand its web page to encompass these new services and initiatives.	**Implemented.** Massport continues to reflect service changes on its website.
Massport and the MBTA will offer, on a trial basis, the sale of MBTA tokens via a vending machine in the baggage claim area of Terminal C.	**Implemented.** The MBTA Charlie Card machines (which replaced tokens) are located at the MBTA's Blue Line Airport Station and in each of the Logan Airport passenger terminals. Massport continues to offer free service to Airport Station and the water shuttle dock with its new fleet of CNG and clean diesel/electric hybrid buses. Since the summer of 2012, Massport has also sponsored a pilot program offering free rides on the Silver Line from Logan Airport to downtown Boston. This program will continue through June 1, 2013.

Note: Text in italics detailing the mitigation measures is excerpted from the Section 61 Findings submitted to the EOEEA, June 26, 1997.

Replacement Terminal A Project – EOEA #12096

Permitting History

- Certificate on the Final EIR issued on November 16, 2000
- Section 61 Findings submitted to EOEEA on August 31, 2001

Project Status

The Replacement Terminal A Project (Figure 9-3) involved the complete demolition of the pre-existing Terminal A and construction of a new facility by Delta Air Lines, consisting of a main terminal linked to a satellite concourse. The old Terminal A was closed in May 2002 and demolition commenced shortly thereafter. The project was designed to be constructed in five phases. However, as a result of September 11, 2001, air traffic at Logan Airport reduced dramatically allowing Massport to relocate the airlines at Terminal A to other terminals with minimal impact, and to shut down Terminal A entirely rather than having to phase construction concurrent with passenger activity. As a result, construction progressed ahead of schedule in 2003 and 2004. Terminal A opened on March 16, 2005.

In the spring of 2006, Delta Air Lines and Massport submitted an application for certification of Terminal A under the U.S. Green Building Council Leadership in Energy and Environmental Design® (LEED) Green Building Rating System™. LEED certification was awarded in June 2006, making Terminal A the first airport terminal in the world to be awarded LEED certification.

The following sustainable elements were incorporated into the design of Terminal A:

- Water conservation — low-flow toilets, waterless urinals, and drip rather than spray irrigation.
- Atmosphere protection — zero use of chlorofluorocarbon (CFC)-based, hydrochlorofluorocarbon (HCFC) based, or halon refrigerants.
- Energy conservation — special roofing and paving materials that reflect solar radiation. Solar panels were installed on the roof of Terminal A in 2012.
- Materials and resources conservation — more than 10 percent of all the building materials used to construct the terminal were from recycled materials.
- Enhanced indoor environmental air quality — low and volatile organic compound (VOC) free adhesives, sealants, paints, and carpets were used, and smoking is prohibited inside the terminal building.
- Sustainable sites — bicycle racks were installed in proximity to bus and subway systems.

Figure 9-3 Replacement Terminal A Project

Note: Runway 14-32 construction completed in November, 2006.

Table 9-4 lists each mitigation measure in the Section 61 Findings along with Massport's progress in achieving these measures through the end of 2011.

Table 9-4 Replacement Terminal A Project Status Report (EOEA #12096) Section 61 Mitigation Measures (as of December 31, 2011)

Mitigation Measure	Status
Project Design Mitigation	
Logan TMA Participation	
Delta Air Lines, Inc. has joined Massport's Logan TMA. Delta Air Lines will designate an Employee Transportation Advisor at Terminal A to be the conduit between the Logan TMA Coordinator and Delta Air Lines employees.	**Implemented.** Delta Air Lines joined the Logan Transportation Management Association (TMA) and designated an Employee Transportation Advisor.
Additionally, Delta Air Lines will provide the following services as part of their Transportation Demand Management Program through the Logan TMA Transportation subsidy for full-time Delta Air Lines employees at Logan Airport; ride matching/carpooling; vanpooling; guaranteed ride home; preferential parking for HOVs; shuttle to and from employee parking.	**Implemented.** Transportation Demand Management (TDM) services are provided through the Logan TMA.
Recycling Program	
The Replacement Terminal A will be included in within Massport's terminal recycling program.	**Implemented.** Paper, plastic, aluminum, glass, and cardboard are recycled at Terminal A.
High Occupancy Vehicle (HOV) Promotion	
HOV access can be accommodated on the departures level and will be designated near main entrances to the terminal building to ensure efficient and convenient unloading by air passengers who use these mode-types to access the Airport.	**Implemented.** HOV access has been incorporated into the final design. HOV lanes give HOV modes preferential access to Terminal A for passenger convenience at both the arrival and departure levels.
The inner-most curb of [the arrivals level] will be designated exclusively for HOVs and taxis, similar to the departures level.	The Silver Line service has a dedicated stop at Terminal A on the inner-most curb. New digital next bus signage was installed at the curb in 2012.
Ground Service Equipment (GSE) Conversion	
In conjunction with the Project, Delta Air Lines will implement a program for conversion of its entire GSE fleet at Terminal A as soon as viable alternative fueled fleet vehicles become available and can be effectively integrated into Delta Air Lines' operations at Terminal A. Delta Air Lines will introduce battery powered baggage tugs and belt loaders with the replacement terminal and convert this portion of the GSE fleet by the end of 2008. This represents over 40 percent of Delta Air Lines' current GSE fleet.	**Implemented.** The Terminal A design incorporates infrastructure for GSE charging. In September 2009, Massport approved a $3 million dollar loan to Delta Air Lines for the purchase of battery-powered baggage tugs and battery powered-baggage conveyor belt vehicles. Delta Air Lines purchased 50 electric baggage cart tugs, 25 electric baggage conveyor belt vehicles, and charging stations for each vehicle. Thirty-two GSE charger installations have been completed, and are currently serving electric GSE.
Delta Air Lines will also examine the feasibility of locating a Compressed Natural Gas (CNG) fill station at Terminal A. The availability of a CNG fueling station would facilitate conventionally-fueled vehicles to be replaced with CNG-fueled vehicles where this vehicle option is offered. Delta Air Lines will introduce these vehicles into its GSE fleet as soon as they become available and are determined to be feasible and practicable for use at Terminal A.	**Implemented.** Delta Air Lines examined the feasibility of locating the CNG fill station at Terminal A and determined it to be infeasible given that the GSE conversions are trending toward electric vehicles. A CNG fuel facility is available on the Airport at 81 North Service Road.
Where new AFVs are developed and determined to be cost effective and in available supplies, Delta Air Lines will integrate their use into its Terminal A GSE fleet operations.	**Implemented.** As described earlier, Delta Air Lines has purchased electric baggage tugs and belt loaders and will continue to determine the feasibility of integrating other alternative fuel GSE, as available.

Table 9-4 Replacement Terminal A Project Status Report (EOEA #12096) Section 61 Mitigation Measures (as of December 31, 2011) (Continued)

Mitigation Measure	Status
Finally, Delta Air Lines will provide Massport with an annual status report/update on the GSE conversion program at Terminal A, for inclusion in Massport's annual EDR.	**Implemented.** Terminal A includes 32 electric charging stations for Delta Air Lines' electric ramp vehicles. Delta Air Lines continues to study which AFVs and infrastructure are best suited for its future GSE operations.
Operational Mitigation Measures	
Minimizing nighttime movement of aircraft to and from hardstand positions.	**Implemented.** In accordance with the Noise Rules, Massport continues to restrict nighttime movement of aircraft under their own power between 10:00 PM and 7:00 AM, and Massport also requires towing during this time period.
Using single engine taxiing and pushback to the extent feasible and practicable, recognizing that such use always at the discretion of the pilot in charge of the aircraft based upon his or her experience and safety and operational considerations.	**Implemented.** Massport has conducted two surveys of Logan Airport air carriers (2006 and 2009) to understand the extent single engine taxiing is used at Logan Airport. Massport also issued a letter to air carriers in support of single engine taxiing when consistent with safety procedures in 2006. Massport is an active member of the Federal Aviation Administration (FAA) Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) program on reducing noise and emissions. In 2009, Massport offered to facilitate the undertaking by the Massachusetts Institute of Technology (MIT) of a more detailed survey of pilots at Boston Logan Airport to better understand the use of single engine taxiing. MIT completed its survey and issued a paper in March 2010 (as provided in the *2010 Environmental Data Report [2010 EDR]*) The MIT survey confirms earlier Massport survey findings that single engine taxiing is an important operational measure used by airlines to conserve fuel and is extensively used at Logan Airport. Based on the more detailed survey results, Massport will tailor future communication to airlines to further encourage the use of single engine taxiing, when safe to do so, within the Logan Airport operational context. In January 2011, Massport sent letters to the Boston Airline Community and the Logan Airport user community encouraging them to consider the use of single engine taxiing when safe to do so. This is provided in *Appendix M* of this *2011 ESPR.*
Testing alternative de-icing methods to reduce the amount of glycol usage.	**Ongoing.** Delta Air Lines is currently using sodium formate, an environmentally friendly deicing material, for pavement deicing. Delta Air Lines will continue to investigate additional de-icing alternatives.

Source: Massport
Note: Text in italics detailing the mitigation measures is excerpted from the Section 61 Findings submitted to the EOEEA, August 31, 2001.
1 Details are available in the Section 61 Findings.

Logan Airside Improvements Planning Project – EOEA #10458

Permitting History

- Certificate on the Final EIR issued on June 15, 2001.
- Section 61 Findings dated June 8, 2001 on the Final EIR.
- In June 2002, the Federal Aviation Administration (FAA) filed a Final Environmental Impact Statement (FEIS) and issued the Record of Decision (ROD) in August 2002 approving a unidirectional runway and other improvements, but deferred a decision on the centerfield taxiway pending additional review by the FAA.
- In November 2003, the Superior Court of the Commonwealth modified a 1976 injunction prohibiting construction of a new runway at Logan Airport, pending further environmental review. The injunction modification allowed construction of the runway in accordance with the MEPA Certificate on the Final EIR and the FAA's ROD on the Final EIS.
- In accordance with the Secretary of EOEEA's Certificate on the Final EIR, Massport amended its final Section 61 Findings issued in 2001 to incorporate mitigation measures added or refined through the federal environmental review process. As a result, Massport amended its initial Section 61 Findings on October 21, 2004, to include mitigation measures required of it in the FAA's ROD.
- In April 2007, the FAA issued a ROD on the centerfield taxiway improvements based on its review of supplemental information.

Project Status

- Project construction commenced in 2004. Runway 14-32 opened on November 23, 2006. 2007 was the first full year of operation of Runway 14-32.
- Realignment of the southwest corner taxiway system was completed in 2007.
- Taxiway D extension was completed in 2010.
- Taxiway N realignment is anticipated to commence after 2015.
- Reduction in approach minimums on Runway 15R and 33L will be implemented in early 2013 following completion of the 33L Light Pier replacement and FAA testing of new Instrument Landing System (ILS) equipment.

The Logan Airside Improvements Planning Project (Figure 9-4) involved the construction of a new unidirectional Runway 14-32 and centerfield taxiway, extension of Taxiway D, realignment of Taxiway N, improvements to the southwest corner taxiway system, and reduction in approach minimums on Runways 22L, 27, 15R, and 33L. Reduction in approach minimums on Runway 15R and 33L were approved in the EIS. However, implementation for approach minimum reductions depends upon realignment of the ILS. The construction impacts of relocating the ILS localizer and new CAT III ILS equipment were addressed in the environmental review of the RSA enhancements for Runway 33L (EOEA #14442). CAT III ILS is planned to begin operations in 2013.

Table 9-5 summarizes the mitigation measures contained in the amended Section 61 Findings issued on October 21, 2004 and reports on the status of implementation. Table 9-5 addresses only ongoing requirements, and it is noted when there are recent updates. Documentation on design and construction measures is contained in previous EDRs.

Figure 9-4 Logan Airside Improvements

Note: Runway 14-32 construction completed in November, 2006.

Table 9-5 Logan Airside Improvements Planning Project (EOEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011)

Project Design and Mitigation Measures	Status
Runway 14-32 Operations and Construction Mitigation	
Operational procedures for unidirectional Runway 14-32 will include over water flight operations only, arrival operations in east-to-west direction from Runway 32 approach end, and departure operations from west-to-east direction from the Runway 14 departure end. Massport will enter into contract with appropriate government body and/or community group(s) to enforce intended unidirectional runway, if requested. Lighting, marking, and instrumental components of Runway 14-32 will be designed for a unidirectional runway. No parallel or other type taxiway facility will be constructed to allow east-to-west direction departures from the Runway 32 end.	**Implemented.** Runway 14-32 was constructed for unidirectional operation. All lighting, marking and navigational instrumentation was constructed and is operated for unidirectional use only. There is no parallel or other type of taxiway facility that would facilitate east-to-west direction departures from the Runway 32 end. The construction mitigation measures were incorporated into the final design specifications and were implemented during construction. Runway 14-32 opened on November 23, 2006.

**Table 9-5 Logan Airside Improvements Planning Project (EOEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011) (Continued)**

Mitigation Measure	Status
FAA endorsed the unidirectional limitations on Runway 14-32 and has agreed to develop air traffic control procedures to ensure safe and efficient operation of the unidirectional limitation, subject to variances that may be required to accommodate particular aircraft emergencies.	
Wind-Restricted Use of Runway 14-32	
Restrict the use of Runway 14-32 to those times when winds are equal to or greater than 10 knots from the northwest or southeast (between 275 degrees and 005 degrees, or 095 degrees and 185 degrees, respectively).	**Implemented.** Massport provided initial data to support Federal Aviation Administration's (FAA) effort. The FAA implements the wind restriction in compliance with the federal Record of Decision (ROD).
Mitigation Policies/Programs	
Regional Transportation Policy	
Engage in promoting increased utilization of regional airports *Cooperative transportation planning with the various transportation agencies to ensure an integrated regional transportation infrastructure, i.e., improved highways, public transportation, high-speed rail, private transportation services to improve regional airport access.*	**Implemented.** During 2001, Massport, together with the FAA and the six New England Regional State Aviation Directors developed a scope of work and selected a technical team to undertake the New England Regional Aviation System Plan (NERASP) Update study. In 2002, the Massport Board approved 10 percent funding with a 90 percent federal match toward the $1.6 million study. Please refer to *Chapter 4, Regional Transportation,* for additional information on Massport's cooperation on regional transportation efforts.
Massport will continue to exercise operational control over Worcester Regional Airport.	**Implemented.** The Authority exercised operational control over Worcester Regional Airport as part of Massport's agreement with the City of Worcester which went into effect on January 15, 2000. In April 2004, Massport and the City of Worcester agreed to a three-year extension of the Operating Agreement, extending Massport's operation of the Airport through June 2007. Subsequently, both parties agreed to a further extension. Legislation was passed in 2009 requiring Massport to assume ownership of Worcester Regional Airport. Massport's ownership of Worcester Regional Airport commenced on July 1, 2010.
Massport will continue to attract new air service to Worcester Regional Airport.	**Implemented.** Following the events of September 11, 2001, the last commercial operator, US Airways Express, ceased operations out of Worcester in early 2003. In 2003 and 2004, Massport continued to work with the City to attract passenger service for the Worcester Regional Airport. Service by Allegiant Airways commenced in December 2005 but ceased in September 2006. Commercial passenger service was regained when Direct Air began scheduled charter services in November 2008, but commercial passenger services ceased again in 2012. Massport continues to work with carriers and make other facility improvements to develop and sustain commercial service from Worcester.

Table 9-5 Logan Airside Improvements Planning Project (EOEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011) (Continued)

Mitigation Measure	Status
Traveler and air service awareness will be provided to Worcester Regional Airport via marketing campaigns.	**Implemented.** In 2011, Massport continued marketing of Worcester Regional Airport following the beginning of Direct Air commercial service at the airport in November 2008. Direct Air ceased operations at Worcester Airport in 2012. Massport continues to aggressively market the Airport to potential commercial air service carriers.
Develop and maintain an aviation information database to include: aviation trend tracking reports for distribution to interested parties; statistical summaries of passenger levels, aircraft operations and airline schedule data at major New England regional airports; include a summary of regional airport trends and service developments an Annual Report.	**Implemented.** Massport collects regional airport data. A summary of individual airport activity is published annually in the Environmental Data Reports (EDR), and in the Environmental Status and Planning Reports (ESPR).
Participate in other regional/state aviation forums.	**Implemented.** The NERASP study was completed in the fall of 2006. Massport continues to participate in regional and state aviation forums as they exist. Please refer to *Chapter 4, Regional Transportation,* for additional information on Massport's cooperation on regional transportation efforts.
Continue to work with FAA/regional airport directors to complete a New England Airports System Study to evaluate regional airports performance. FAA committed to work with other participants in the preparation of the study.	**Implemented.** The NERASP Study was published in October 2006.
Encourage transportation initiatives (i.e., commuter rail, rail or other links between regional airports) by relevant agencies or other governmental bodies through Transportation Bond Bill or other legislative initiatives to implement an improved effective regional transportation system.	**Implemented.** Massport continues to provide support for regional transportation legislation and funding for other modes of transportation including the MBTA Silver Line and water transportation. Massport's support was instrumental in the opening of the Anderson Regional Transportation Center (RTC) in Woburn which provides a station building for ticketing, baggage and passenger services, approximately 2,400 parking spaces for daily and overnight parking, loading platforms for Logan Express and local buses, improved access from Interstate 93 via a new interchange constructed and opened by the Massachusetts Department of Transportation (MassDOT, formerly the Massachusetts Highway Department) and a new high-level platform commuter rail station.
Continue to support inter-city rail planning through the Boston Metropolitan Planning Organization (MPO).	**Implemented.** Massport continues to actively participate in the Boston MPO and contributes to the policy discussions in all modes of transportation.
Allow Massport's Logan Express satellite parking lots and stations available for third-party bus and park-and-ride connections to other regional airports, including Worcester, Manchester, and Providence.	**Implemented.** Upon request and review, Massport will continue to allow third party bus operators to provide service to regional airports from Logan Express facilities. In 2007, Massport enacted an agreement with Manchester-Boston Regional Airport to allow operation of a shuttle service between Manchester-Boston Regional Airport and the RTC in Woburn. That pilot program was replaced by hourly van service in 2008.

Table 9-5	Logan Airside Improvements Planning Project (EOEA #10458) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011) (Continued)
Mitigation Measure	**Status**
Sound Insulation: *Sound insulation is being provided within the Boston Logan Airside Improvements Planning Project Mitigation Contour including the affected residences of Chelsea, East Boston, Winthrop and Revere. Through special project mitigations, FAA funding will be provided for residences with building code considerations to allow for the necessary upgrades thereby ensuring eligibility and participation in the sound insulation program. If FAA funding is unavailable to complete sound insulation to residences within the DNL 65 dB contour as a result of project implementation, Massport will provide the funding." See Chapter 6, Noise Abatement for additional details on Sound Insulation.*	**Implemented.** Sound insulation is being implemented in full compliance with state and federal regulatory requirements and mitigation commitments. Since 1986, Massport has sound insulated over 6,000 homes totaling over 11,000 dwelling units within several day-night sound level (DNL) 65 decibel (dB) Noise Exposure Contours.
Preferential Runway Advisory System (PRAS) *Massport will develop and implement a PRAS monitoring system and a new distribution system for reporting that will expand the contents of Massport's Quarterly Noise Reports and will involve the expansion of the distribution list to include the Logan Airport Citizens Advisory Committee (CAC). Runway utilization, dwell and persistence reports will be included in the ESPR filings with MEPA. Massport will continue to work with FAA to design additional reports to enhance the attainment of PRAS and Massport will begin to work with CAC to update PRAS. The current PRAS system will remain in place until superseded.*	**Implemented.** Massport, FAA, and the CAC initiated a noise study of Logan Airport. PRAS review and reporting are incorporated into the noise study. During Phase 2 of the on-going Boston Logan Airport Noise Study (BLANS) the Logan Airport Community Advisory Committee (CAC) voted to abandon PRAS because it had not achieved the intended noise abatement. For additional information, refer to *Chapter 6, Noise Abatement.* Runway utilization, dwell and persistence reports continue to be included in the annual ESPR and EDR filings.
Noise Abatement Study *FAA has committed to undertake a noise abatement study that will include enhancing existing or developing new noise abatement measures applicable to aircraft overflight impacts, which will take into account environmental benefit, operational impact, aviation safety and efficiency, and consistency with applicable legal requirements. The scope of this study has been completed through the joint efforts of FAA, the CAC, and Massport as required by the ROD. Massport will work with the CAC and FAA to assess the existing PRAS at Logan Airport in accordance with Section 10.0 of the Section 61 Findings and will continue to participate in the noise study as contemplated in the ROD.*	**Implemented.** The FAA, in conjunction with Massport and the Logan Airport CAC, initiated the Boston Overflight Noise Study (BONS). Phase 1 of the study, completed in early 2007, defined and will seek to implement changes to flight tracks to minimize impacts from aircraft overflights which do not require a detailed Environmental Assessment (EA). Federal funding for Phase 2 was requested early to ensure seamless continuation of the study and transition. Phase 2, of the BLANS, was completed in 2012. It addressed additional noise abatement alternatives that will require detailed analysis to meet FAA environmental requirements. FAA has begun implementing new aRea NAVigation (RNAV) procedures that were designed in Phase 1. Please refer to website www.bostonoverflight.com for more details.

Table 9-5 Logan Airside Improvements Planning Project (EOEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011) (Continued)

Mitigation Measure	Status
Peak Period Monitoring and Demand Management Program (DMP)	
Massport will develop and implement a Peak Period Pricing (PPP) program or an alternative DMP. Massport will identify standards to allow airlines to accurately predict scheduling costs and modify accordingly. Massport will establish and maintain a monitoring system. *Massport will comply with its commitments with respect to PPP or alternate DMP. FAA has indicated in the ROD that it stands ready to assist Massport in this endeavor.*	**Implemented.** In July 2004, Massport filed a proposed rule with the Office of the Massachusetts Secretary of State to formally initiate the state rulemaking process and public review of a proposed rule to establish a peak period surcharge during designated peak delay periods at Logan Airport. The filing was followed by a public comment period that lasted through November 15, 2004. During the comment period, Massport conducted two public hearings to receive comments on the proposed regulation. The Massport Board voted to establish the peak period surcharge program on January 16, 2005. The program has been in place since that date. Please refer to *Appendix K, 2011 Peak Period Pricing Monitoring Report.*
Single Engine Taxi Procedures	
Develop and implement a program designed to maximize the use of single engine procedures by all tenant airlines, consistent with safety requirements, pilot judgment and Federal law requirements.	**Implemented.** Massport supports the use of single engine taxiing when it can be done safely, voluntarily and at the discretion of the pilot. Massport has conducted two surveys of Logan Airport air carriers (2006 and 2009) to understand the extent single engine taxiing is used at Logan Airport. Massport also issued a letter to air carriers in support of single engine taxiing when consistent with safety procedures in 2006. Massport is an active member of the FAA Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) program on reducing noise and emissions. In 2009, Massport offered to facilitate the undertaking by MIT of a more detailed survey of pilots at Boston Logan Airport to better understand the use of single engine taxiing. MIT completed its survey and issued a paper in March 2010 (as provided in *Appendix M* of this *2011 ESPR*). The MIT survey confirms earlier Massport survey findings that single engine taxiing is an important operational measure used by airlines to conserve fuel and is extensively used at Logan Airport. Based on the more detailed survey results, in January 2011, Massport issued a new letter to air carriers in support of single engine taxiing when consistent with safety procedures. A copy of that letter is included in *Appendix M of this 2011 ESPR.*
Report on Progress of Logan Transportation Management Association (TMA)	**Implemented.** *Chapter 5, Ground Access to and from Logan Airport* of the *2011 ESPR* discusses the status of the Logan TMA and efforts to increase Logan TMA membership and overall high occupancy vehicle (HOV) access to Logan Airport. Since MassRIDES began management of the Logan TMA in January 2006, the joint focus has been on expanding Logan TMA services, broadening HOV options, and supporting all major Logan Airport tenants to become members and actively participate in the Logan TMA. In 2007, the Logan TMA implemented three new programs: Sunrise Shuttles; Logan TMA Preferential Carpooling; and Commuter Cash program.

Source: Massport
Note: The mitigation measures in italics are those that were referenced in the FAA's ROD and later incorporated into the October 21, 2004 amended Section 61 Findings.

Southwest Service Area (SWSA) Redevelopment Program, EOEA # 14137

Permitting History

- Certificate on the Final EIR issued on May 28, 2010
- Section 61 Findings submitted to EOEEA on June 29, 2010

Project Status

Massport is redeveloping the SWSA and constructing a new consolidated rental car facility (ConRAC). Consolidation of the rental car operations and their shuttle buses into one coordinated operation will result in reduced vehicle miles traveled and associated air emissions.

Construction of enabling projects commenced in late summer 2010 as final design of the facility continued through 2011. All ConRAC facilities (the Garage Structure, Customer Service Center (CSC), permanent Quick Turnaround Areas (QTAs) 1 and 2, and temporary QTAs 3 and 4) would be constructed first. The first rental car companies are expected to move into the QTA 1 in mid-2013 and the remaining companies by early 2014. By 2014, the entire project will be completed and operational. Table 9-6 outlines the SWSA Redevelopment Program Section 61 commitments which Massport, the construction contractors, and the rental car companies will implement as part of the design, construction and operation of the facility. This project is currently under construction, and there is updated progress for each mitigation measure.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011)

Mitigation Measure	Status
Site Design	
Stormwater Management	
Improve quality of runoff by upgrading stormwater management facilities site-wide, reducing the volume of flow to the Maverick Street Outfall by increasing pervious area site-wide, utilization of Low Impact Design elements, and replacing uncovered parking areas with buildings.	**To be implemented.** These stormwater design features are included in the final project design and will be part of the completed project now under construction. The stormwater features include 27 stormceptors that will be constructed as part of this project. Stormceptors are prefabricated, underground units that separate oils, grease, and sediment from stormwater runoff when installed as part of a pipe conveyance system.
Design new sanitary and drainage systems to result in an overall reduction in combined sewer overflow volumes at the Porter Street Outfall and eliminate discharge to Maverick Street Outfall and Bird Island Flats/West Outfall.	**Implemented.** The sanitary sewer system designed for the ConRAC project adds new connections at Gove Street and Harborside Drive. Sanitary flows to the Maverick Street sewer will be significantly reduced once the connection is completed. Massport submitted a pre- and post-development stormwater analysis with the Notice of Intent (NOI) for the ConRAC project, as required by MassDEP's Stormwater Management Regulations. The stormwater analysis shows an overall reduction in the post-development stormwater flows for the project, as well as reductions in flows to the Porter Street and West Outfalls and elimination of stormwater flow to the Maverick Street Combined Sewer. Both the sanitary sewer system and stormwater drainage system are now under construction.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011)

Mitigation Measure	Status
Remediation and Underground Fuel Storage Systems	
Remove all existing car rental fueling systems and associated tanks and replace with current, state-of-the-art vehicle fueling and washing facilities.	**To be implemented.** This element will be implemented as part of the quick turnaround facilities.
Develop a Soil Management Plan and submit to the MassDEP prior to construction for the Activity and Use Limitations (AUL) areas.	**Implemented.** As required by the ConRAC project specifications, the Project Contractor submitted an Excavated Materials Management & Disposal Plan prepared by a Licensed Site Professional (LSP) and submitted it on March 25, 2011 for Massport review and approval. Two Release Abatement Measure (RAM) Plans for work within AUL areas were submitted by the Contractor's LSP to the DEP in accordance with the MCP. Construction occurred within two AUL areas, associated with MCP sites identified by Release Tracking Number (RTNs) 3-00956 and 3-2690, and submittal of the RAM Plans were required to detail procedures for managing contaminated soil. RAM Status Reports have been submitted on a 6-month schedule documenting soil management activities, and electronic files of these reports can be accessed by searching the RTNs on the DEP website.
During construction, the soil and groundwater environmental issues surrounding the existing rental car operations would be addressed in compliance with the Massachusetts Contingency Plan (MCP).	**Implemented.** During construction, any soil and groundwater issues surrounding the existing rental car operations are being addressed in compliance with the MCP.
Noise Reduction Measures	
Eliminate individual rental car shuttle buses and combine Massport Airport Station buses (routes 22/33/55) through the Unified Bus System; thereby, reducing the overall number of rental car-related buses circulating on-airport and associated noise.	**To be implemented.** Massport purchased a new Bus Fleet which was put into operation in 2012. The bus fleet is comprised of 18 compressed natural gas (CNG) buses and 32 clean diesel/electric buses that have already replaced Massport's older fleet of 26 CNG buses and will ultimately replace the entire fleet of diesel rental car shuttle buses once the ConRAC is fully operational in 2014.
Incorporate noise reduction strategies into site design, such as solid fences/walls, gateway signs/walls, and landscaped berms.	**To be implemented.** This element is included in the final design and is under construction.

Table 9-6	Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011) (Continued)
Mitigation Measure	**Status**
Phase 2 SWSA Airport Edge Buffer and Other Site Landscaping	
Construct other site landscaping that encourages walking/biking by providing safe and welcoming corridors, reduces environmental impact (water efficient; reduce and filter runoff), and screens the SWSA from neighboring properties.	**To be implemented.** This element is included in the final design and will be part of the completed project.
Building Design	
Energy Efficiency	
Optimize daylight and natural ventilation within the Garage Structure (a Code classification for an "open parking structure") to eliminate the need for substantial mechanical ventilation systems.	**To be implemented.** This element is included in the final design and is under construction.
Reduce energy consumption by a minimum of 20 percent (as required by MA LEED Plus) by properly sizing building mechanical systems and incorporating high performance/energy efficient mechanical and electrical building systems, such as highly-reflective (high-albedo) roofing materials, reduced lighting intensities, high-efficient heating and cooling systems, and daylighting techniques with window and skylight glazing.	**To be implemented.** This element is included in the final design and is under construction.
Reduce overall electricity consumption by 2.5 percent through the use of on-site renewable energy (which contributes to the overall 20 percent energy efficiency performance criteria above).	**To be implemented.** This element is included in the final design and is under construction.
Conduct a third-party commissioning process to ensure the effectiveness of building systems (as required by MA LEED Plus).	**To be implemented.** Third party commissioning will occur upon building completion.
Water Efficiency and Wastewater Reduction	
Reduce water use demand by a minimum of 20 percent (as required by MA LEED Plus) and to strive for a 30 percent reduction through utilization of high-efficient/ low-flow plumbing fixtures and car wash water reclamation systems.	**To be implemented.** This element is included in the final design and is under construction.
Reduce water use demand and wastewater generation by reclaiming and reusing car washing water.	**To be implemented.** This element is included in the final design and is under construction.
Potential collection of and reuse of stormwater runoff for irrigation of landscaped areas.	**To be implemented.** This element is being considered as part of the final design. A rain garden has been included in the final design as a method to control stormwater runoff, and will be implemented as part of the project.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011) (Continued)

Mitigation Measure	Status
Noise Reduction Measures	
Improve the Quick Turnaround Areas (QTAs), including the elimination of outdoor loudspeakers, elimination of car drying blowers through state-of-the-art equipment, enclosed vacuum compressors, and incorporation of six to eight-foot high solid walls/fences designed to further reduce noise from activities at the QTA facilities, including car washing and vehicle movements.	**To be implemented.** This element is included in the final design and is under construction.
Transportation and Parking	
Roadway Improvements	
Reconstruct Porter Street, including turnaround for exiting taxis.	**To be implemented.** This element is included in the final design and is under construction.
Reconfigure SR-14 and new alignment of Ramp 1A-S.	**To be implemented.** This element is included in the final design and is under construction.
Construct new dedicated Unified Bus System access and ramp off of SR-14.	**To be implemented.** This element is included in the final design and is under construction.
Reconstruct traffic signals and pedestrian accommodations at the Harborside Drive/Porter Street intersection.	**To be implemented.** This element is included in the final design and is under construction.
Reconstruct, widen and convert Jeffries Street to one-way northbound, between Harborside Drive and Tomahawk Drive.	**To be implemented.** This reconfiguration is underway.
Reconstruct traffic signals and pedestrian accommodations at the Harborside Drive/Jeffries Street intersection.	**To be implemented.** This element is included in the final design and is under construction.
Construct the extension of Tomahawk Drive –a one-way westbound roadway connecting Harborside Drive with the Maverick Street Gate and Garage Structure.	**To be implemented.** This element is included in the final design and is under construction.
Reconstruct traffic signals and pedestrian accommodations at the Harborside Drive/Hotel Drive intersection.	**To be implemented.** This element is included in the final design and is under construction.
Reconfigure inbound lane of the Maverick Street Gate to provide additional queue storage.	**To be implemented.** This element is included in the final design and is under construction.
Airport Transportation System Improvements	
Reduce the rental car shuttle bus fleet by approximately 70 percent through the creation of the Unified Bus System when compared to the 2007 Existing Condition and future No-Build/No-Action Conditions.	**To be implemented.** Massport purchased a new Unified Bus Fleet of diesel/electric hybrid and CNG buses. The initial buses were put into operation in 2012. Full implementation of the new bus fleet will occur when the ConRAC opens.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011) (Continued)

Mitigation Measure	Status
Reduce rental car shuttle bus terminal curbside congestion through the creation of the Unified Bus System resulting in reduced emissions.	**To be implemented** upon project opening. Massport purchased a new Unified Bus Fleet which was put into initial operation in 2012.
Utilize clean- and low-emission fuel for the Unified Bus System to further reduce emissions.	**To be implemented** upon project opening. Massport has purchased a new Unified Bus Fleet. The new fleet is comprised of diesel/electric hybrid and CNG buses.
Install Intelligent Transportation System features, as part of the Unified Bus System to further reduce emissions and improve operational efficiency.	**To be implemented** upon project opening. Massport purchased a new Unified Bus Fleet which was put into initial operation in 2012.
Implement new wayfinding signage to increase the efficiency of the circulating vehicles within and around the SWSA.	**To be implemented** upon project opening. This element is included in the final design and is under construction
Pedestrian and Bicycle Facilities	
Provide new pedestrian and bicycle facilities, including secure and covered bicycle storage at the Customer Service Center (CSC) and QTA buildings for employees, customers and the general public, as well as shower/changing facilities within the QTA buildings for employees.	**To be implemented.** This element is included in the final design and is under construction
Provide enhanced pedestrian connections to and from the SWSA, airport terminals, the Logan Office Center, Memorial Stadium Park, Bremen Street Park, the Harborwalk, on-airport buses, public transit (MBTA Airport Station), along Porter Street, and surrounding East Boston neighborhoods.	**To be implemented.** This element is included in the final design and is under construction
Provide street and pedestrian-level lighting and advanced warning signals and/or systems at crosswalks.	**To be implemented.** This element is included in the final design and is under construction
Transportation Demand Management (TDM) Plan	
Provide limited SWSA employee parking on-site.	**To be implemented.** Limited on-site employee parking is included in the final design.
Provide new access to public transit through the Unified Bus System (direct connection to MBTA Blue Line at Airport Station) and new/enhanced pedestrian facilities at the station.	**To be implemented.** This element is included in the final design and is under construction.
Require rental car companies to participate in the Logan Transportation Management Association (TMA).	**Implemented.** This requirement is included in new consolidated car rental facility (ConRAC) tenant leases.
Alternative-Fuel Vehicles	
The rental car companies would provide fuel-efficient and/or alternative-fueled rental vehicles (quantity to be determined by the rental car companies).	**Implemented.** This requirement is included in new ConRAC tenant leases.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2011) (Continued)

Mitigation Measure	Status
Off-Airport Improvements/Benefits	
Reconstruct Frankfort Street/Lovell Street intersection to provide a new traffic signal control and pedestrian-related improvements (for temporary impacts of the relocation of the Bus and Limousine Pools to the North Service Area (NSA) during construction).	**Implemented.** This element is completed.
Reduce the amount of off-airport car shuttling to and from off-airport locations, further reducing traffic on Route 1A and local roadways surrounding the airport due to the consolidated and expanded rental car "ready/return" parking spaces and QTA areas at the SWSA.	**To be implemented** upon project opening.
Construction Management	
Aim to divert/reduce construction waste to landfills.	**Implemented,** construction underway.
Implement Erosion and Sedimentation Control Program.	**Implemented,** construction underway.
Retrofit certain diesel construction equipment types with diesel oxidation catalyst and/or particulate filters (in accordance with the DEP Clean Air Construction Initiative).	**Implemented,** construction underway.
Require the use of ultra-low sulfur diesel fuel for off-road construction vehicles and/or equipment.	**Implemented,** construction underway.
Construction worker vehicle coordination and trip limitation, including requiring contractors to provide off-airport parking and use of high-occupancy vehicle transportation modes for employees.	**Implemented,** construction underway.
To ensure no changes in the conditions of abutting homes due to pile driving, Massport will require the Contractor to inspect the conditions of the abutting homes prior to and following pile driving activities.	**Implemented.** Preconstruction residential survey completed. Construction underway.

Source: Massport

Recently Approved Projects with Upcoming Mitigation Requirements

Logan Airport RSA Project – EEA #14442

Permitting History

- Certificate on the Final EA/EIR issued on March 18, 2011.
- The FAA issued a Finding of No Significant Impact (FONSI) on April 4, 2011, which documents that the proposed Federal action is consistent with the National Environmental Policy Act of 1969 (NEPA) and other applicable environmental requirements and will not significantly affect the quality of the human environment with the mitigation requirements referenced in Table 9-7.
- Section 61 Findings were submitted to EOEEA on May 27, 2011, and published in the *Environmental Monitor* on June 8, 2011.

- Certificate on the Notice of Project Change (NPC) for the replacement of the Runway 33L approach light pier issued on March 9, 2012.
- On April 12, 2012 the FAA found that the replacement of the Runway 33L approach light pier was a Categorical Exclusion and thus exempt from further consideration under NEPA.

Project Status

- The first construction season for the Runway 33L RSA commenced in June 2011 and ended in November 2011. The second construction season started again in June 2012 and the project was completed in November 2012.
- Replacement of the Runway 33L approach light pier commenced in July 2012 and was completed in November 2012. The upgraded CAT III system is expected to be in service in 2013.

As described in previous EDRs/ESPRs, Massport has periodically undertaken RSA improvement projects at other Logan Airport runways. Massport has completed safety improvements for Runways 22L, 4L/4R, and 27 under EOEA #5122. In 2005, Massport began undertaking safety improvements at Runway 22R with the construction of an Engineered Materials Arresting System (EMAS) bed at the end of the runway in compliance with FAA directives, although no MEPA review was needed. In 2006, as part of a separate project, Massport installed an EMAS bed at the Runway 33L End. The current project, the Logan Airport RSA Project, considered further enhancements to the Runway 33L and Runway 22R RSAs. Massport prepared a combined EA in accordance with NEPA and an EIR in accordance with MEPA for the proposed enhancements at the Runway 33L and Runway 22R RSAs. The ENF was filed with MEPA on June 30, 2009, and the Draft EA/EIR was submitted to FAA and EOEEA on July 15, 2010. The Final EA/EIR was submitted to FAA and EOEEA on January 30, 2011. Figure 9-5 indicates the status of RSA projects at Logan Airport.

The Runway 33L RSA improvements include a 600-foot long RSA with an EMAS bed, portions of which are on a 460-foot long by 303-foot wide pile-supported deck extending over Boston Harbor. Additional elements of the RSA improvements include two emergency access ramps located on either side of the deck and relocation of the perimeter access road. Construction of the pile-supported deck was completed in November, 2012.

The current Runway 33L RSA project replaced the inner 500 feet of the light pier. As construction progressed on the Runway 33L RSA improvements, Massport determined that it would be feasible to replace the remaining Runway 33L approach light pier. In summer of 2012, Massport began replacing the outer approximately 1,900 feet of the existing timber light pier that extends approximately 2,400 feet southeast of Runway End 33L. The existing timber pier was replaced with a new concrete structure along the runway centerline, approximately 10 feet south of the old pier, using concrete pilings. The in-kind replacement reduced the total number of pilings significantly (from over 500 to approximately 150). As part of the reconstruction, the new light pier was also constructed to accommodate upgraded navigational aids. The pier improvements provide the infrastructure necessary to support navigational aids that will facilitate implementation of the reduced aircraft approach minimums previously reviewed and approved by the FAA in a ROD dated August 2, 2002, for the *Logan Airside Improvements Planning Project (Airside Project)*. Massport filed a NPC with MEPA for the proposed light pier replacement on January 31, 2012. On March 9, 2012, the EOEEA Secretary issued an NPC Certificate determining that no further MEPA review was required for the light pier replacement. On April 12, 2012 the FAA found that the replacement of the Runway 33L approach light pier was eligible for a Categorical Exclusion and thus exempt from further review under NEPA.

The Runway 22R improvements will enhance the existing RSA at this location by constructing an ISA, similar to the ISA constructed at the Runway 22L end. Massport chose to construct an ISA because it would enhance the existing RSA and rescue access in the event of an emergency, at a feasible construction cost while minimizing impacts to environmental resources. Construction of the Runway 22R ISA is anticipated to begin after

substantial completion of the Runway 33L RSA enhancements and be completed by 2015. Table 9-7 lists the Section 61 commitments for the Logan Airport RSA Project and Massport's progress in achieving these measures.

Figure 9-5 Runway End Safety Improvements

Table 9-7 Logan Airport Runway Safety Area Improvement Program (EEA # 14442) Section 61 Mitigation Commitments to be Implemented

Mitigation Measure	Status
Protected Resources	
Eelgrass	
Develop a mitigation program that will replace lost eelgrass area and functions by creation of new eelgrass, at a 3:1 replacement to loss ratio.	**Implemented.** Eelgrass was transplanted in 2011, but did not survive through 2012. In 2012, Massport continued to work with the Eelgrass Mitigation Working Group (comprised of federal, state, and local agencies) to identify alternative means of eelgrass mitigation.
Implement sediment control measures.	**Implemented.** Sedimentation control measures were installed and fully maintained.
Store construction barges outside of any eelgrass beds overnight.	**Implemented.** There was no overnight barge storage in or immediately adjacent to eelgrass beds.
Restrict barge movement to designated construction corridors outside of the eelgrass bed.	**Implemented.** There was no barge movement in or immediately adjacent to eelgrass beds.
Provide post-construction monitoring and restoration or any additional areas of eelgrass beds that are inadvertently damaged during construction.	**Implemented.** The post-construction monitoring was conducted in November, 2012.
Salt Marsh	
Restore new salt marsh at a 2:1 replacement to loss ratio.	**To be implemented** as part of future Runway 22R habitat mitigation at Rumney Marsh.
Monitor compensatory salt marsh for success and invasive plant species, and implement an invasive species control plan.	**To be implemented** as part of future Runway 22R habitat mitigation at Rumney Marsh.
Implement erosion and sedimentation control measures according to the Soil Erosion and Sediment Control Plan.	**To be implemented** as part of future Runway 22R habitat mitigation at Rumney Marsh.
Shellfish	
Monitor pilings and substrate at Runway 33L.	**To be implemented beginning 2013.**
Restore approximately 1.1 acres of habitat.	**To be implemented** as part of future Runway 22R habitat mitigation at Rumney Marsh.
Harvest and transplant shellfish from the footprint of the Runway 22R Inclined Safety Area (ISA).	The MA Division of Marine Fisheries (MassDMF) has identified a risk of shellfish disease in the Logan Airport flats, including 22R and has determined that the shellfish should not be relocated.
Execute Memorandum of Agreement with the Massachusetts Division of Marine Fisheries for resource enhancement.	**Implemented.** A Memorandum of Agreement (MOA) with MassDMF was executed on July 30, 2012 and the requirements of the MOA are being implemented.
State-Listed Rare Species	
Identify equivalent area of pavement for removal to maintain area of available habitat at Logan Airport for the upland sandpiper if required by the Massachusetts Natural Heritage and Endangered Species Program.	**To be implemented.** The Massachusetts Natural Heritage & Endangered Species Program (NHESP) has determined that construction time of year restrictions will avoid impacts to state-listed species. These seasonal restrictions will be implemented when construction of Taxiway C-1 is initiated in the future.
Cultural Resources	
Develop an Unanticipated Discovery Plan in accordance with the Board of Underwater Archaeological Resources' Policy Guidance	**Implemented.** An Unanticipated Discovery Plan was developed in accordance with the Board of Underwater Archaeological (BUA) Resources' Policy Guidance and approved by BUA. No resources were discovered during Runway 33L construction.

Table 9-7 Logan Airport Runway Safety Area Improvement Program (EEA # 14442) Section 61 Mitigation Commitments to be Implemented

Mitigation Measure	Status
Water Quality	
Develop and implement a comprehensive Soil Erosion and Sediment Control Plan in accordance with NPDES and MassDEP standards.	**Implemented.** A comprehensive Soil Erosion and Sediment Control Plan was developed and implemented at the outset of Runway 33L construction in June 2011 and maintained through the end of construction in 2012.
Apply water to dry soil to prevent dust production.	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction.
Stabilize any highly erosive soils with erosion control blankets and other stabilization methods, as necessary.	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction.
Use sediment control methods (such as silt fences and hay bales) during excavation to prevent silt and sediment entering the stormwater system and waterways.	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction.
Maintain equipment to prevent oil and fuel leaks.	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction.
Use silt curtains and semi-permanent (overnight) debris booms and other secondary booms and silt fencing around barges for additional containment.	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction.
Contain and pump slurry and/or silty water to a containment area on a construction barge in order to contain runoff	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction.
Noise	
Maintain mufflers on construction equipment.	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction.
Keep truck idling to a minimum in accordance with Massachusetts anti-idling regulations.	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction.
Fit any air-powered equipment with pneumatic exhaust silencers.	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction.
Do not allow nighttime construction.	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction.
Air Quality	
Keep truck idling to a minimum in accordance with Massachusetts anti-idling regulations.	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction.
Retrofit appropriate diesel construction equipment with diesel oxidation catalyst and/or particulate filters.	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction.
Implement construction worker vehicle trip management, including requiring contractors to provide off-airport parking, use high-occupancy vehicle transportation modes for employees, and join the Logan TMA.	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction. Contractors assemble offsite and access the airfield in shared vans. Contractors have access to Logan Airport Transportation Management Association (TMA) services through MassRides.
Traffic	
Limit construction traffic to federal or state highways, restricting the use of East Boston local roadways by construction vehicles.	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction.
Implement construction worker vehicle trip management, including requiring contractors to provide off-airport parking, use high-occupancy vehicle transportation modes for employees, and join the Logan TMA.	**Implemented.** Completed for Runway 33L construction; pending for future Runway 22R construction. Contractors assemble offsite and access the airfield in shared vans. Contractors have access to Logan TMA services through MassRides.

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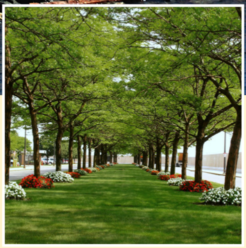

MEPA Appendices

- Appendix A – MEPA Certificates and Responses to Comments
- Appendix B – Comment Letters and Responses
- Appendix C – Proposed Scope for the 2012/2013 EDR
- Appendix D – Distribution

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A

MEPA Certificates and Responses to Comments

- Secretary of the Executive Office of Energy and Environmental Affairs Certificate on the *Logan Airport 2010 Environmental Data Report (2010 EDR)* and Massport's Responses to Comments raised in the Certificate.
- Copies of the Secretary's Certificates on the EDRs issued for the reporting years 2004, 2005, 2006, 2007, 2008, and 2009.

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Secretary of the Executive Office of Energy and Environmental Affairs Certificate on *2010 EDR* and Massport's Responses to Comments Raised in the Certificate

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December 16, 2011

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
2010 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2010 Environmental Data Report
PROJECT MUNICIPALITY	: Boston and Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority (Massport)
DATE NOTICED IN MONITOR	: November 9, 2011

As Secretary of Executive Office of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00).

The environmental review process for Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become, consistent with the objectives of the MEPA regulations, part of Massport's long range planning. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific Environmental Impact Reports (EIR). The ESPR is generally updated on a five year basis, with much less detailed Environmental Data Reports (EDR) (formerly Annual Updates) filed in the years between

ESPRs. The 2010 EDR is the subject of this review. In addition, the Scope for the 2011 ESPR is provided in this Certificate.

In general, the EDR has fulfilled its purpose of providing a "snapshot" of 2010 passenger and impact levels at Logan Airport. Most environmental parameters showed improvement in calendar year 2010. In particular, the technical studies in the 2010 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Mitigation commitments for noise impacts and air quality remain key concerns both of this office and the commenters, and are presented in the form of project-specific Section 61 Findings, as well as more general mitigation that has emerged from the ESPR process.

A-1 The majority of comments received on the EDR focused on noise issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2011 ESPR and future EDRs should also report on the progress and other refinements for tracking noise and abatement efforts, as further described in the Scope for the 2011 ESPR below.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

The last Logan ESPR was filed for calendar year 2004. However, due to the current economic downturn, as described in the 2008 and 2009 EDRs, activity levels at Logan Airport and associated environmental impacts continue to remain well below historic levels. Therefore it was anticipated that in 2010, near-term activity levels and associated environmental effects were also expected to remain well below levels previously analyzed for Logan Airport. Thus, the forecasted aviation growth presented in the 2004 ESPR, the predicate upon which the ESPR schedule was initially established, did not occurr. Therefore, I allowed Massport to prepare a 2010 EDR in lieu of the scheduled ESPR. Massport has prepared the 2010 EDR, which will be followed by a 2011 ESPR. Massport proposed a schedule for filing the next ESPR in light of observed and expected activity levels and any other changes in airport operations that have occurred since the 2004 ESPR was filed.

Review of the 2010 EDR and Scope for the 2011 ESPR

General

The 2011 ESPR should follow the general format of the 2004 ESPR, presenting major policy discussions and an overview of the role of Logan Airport in the regional planning context. This should be followed by a status report on Massport's planning initiatives, projects, and mitigation measures. The ESPR should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs. Massport must provide necessary background information to allow reviewing agencies and the public to understand the environmental policies and planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport. **A-2**

The 2011 ESPR should report on updated passenger and operations activity forecasts for Logan Airport and Massport's other airports, Hanscom Field and Worcester Regional Airport. The new forecast used should begin with 2011 as the base year and project activity forecasts forward to calendar year 2030. In addition, the 2011 ESPR should use the results of the 2010 Logan Airport Air Passenger Survey and the findings of the Sustainable Ground Access Strategy and Service Plan effort to inform future access planning. **A-3** **A-4**

The technical studies in the 2011 ESPR should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2011 ESPR must also respond to those issues explicitly noted in this Certificate and the comments received on the 2010 EDR. **A-5**

A distribution list for the 2011 ESPR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan Environmental Status and Planning Report (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary. **A-6** **A-7**

Responses to Comments

The 2011 ESPR must include responses to comments that address all of the substantive comments from the letters listed at the end of this Certificate. The responses to comments included in the 2010 EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the 2011 ESPR. **A-8**

The majority of comments received on the 2010 EDR focus on noise related issues, including measurement of noise, modeling of noise contours, and noise abatement, and emission

A-9 reduction issues. In addition to responding to these comments, the 2011 ESPR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commenters where appropriate.

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2010 and compares activity levels to the prior year, including air passengers, aircraft operations, fleet mix, and cargo/mail volumes.

There were a number of significant changes in activity at Logan Airport in 2010. The total number of air passengers at Logan Airport increased by 7.5 percent to 27.4 million, compared to 25.5 million in 2009. In comparison, between 2008 and 2009 the number of air passengers using Logan Airport declined by 2.3 percent. This is below the historic peak reached in 2007. Also the total number of aircraft flights grew from approximately 345,310 in 2009 to 352,640, an increase of 2.1 percent. This remains below the historic peak achieved in 1998. Passenger aircraft operations did, however, decrease by 1.6 percent compared to 2009 levels. Compared to a decline of 48.6 percent in 2009, general aviation (GA) operations increased 19.9 percent in 2010, particularly as businesses increased their travel and use of GA transportation as the economy transitioned. GA accounted for 4.2 percent of aircraft activity at Logan Airport in 2010. In addition, dedicated air cargo operations decreased by 5.8 percent compared to the previous year.

The EDR reflects data that shows that the number of air passengers per aircraft operation increased, from an average of 73.9 passengers per aircraft operation in 2009 to an average of 77.8 in 2010. While legacy air carriers continued to reduce the number of aircraft operations at Logan Airport, low-cost carrier (LCC) operations increased by approximately 40 percent in 2010. The increase in operations by LCCs, primarily JetBlue Airways and Southwest Airlines, accounted for nearly all of this growth. Even though the number of dedicated air cargo aircraft operations decreased in 2010, air cargo volumes increased from 546 million pounds in 2009 to 572 million pounds in 2010, an increase of 4.7 percent.

A-10 The 2011 ESPR must report on airport activity levels, including information on aircraft operations, including fleet mix, passenger activity levels, and cargo and mail operations. It should also report on Massport's activity level forecasts that will become the basis for the planning and impact sections that follow and for Massport's strategic planning initiatives over the next few years.

A-11 For the 2011 ESPR, the Activity Levels chapter should include:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Passenger activity levels;

- Cargo and mail activities;
- Compare 2011 aircraft operations, cargo/mail operations, and passenger activity levels to 2010 activity levels; and
- Report on national aviation trends in 2011 and compare to trends at Logan Airport.

A-11 con't.

It should also report on Massport's forecasts that become the basis for the planning and impact sections that follow and for Massport's planning initiatives over the next five years. Future year analyses should be based on the 2030 forecast. It should update the aircraft operations and passenger activity forecasts, and provide a discussion of analysis methodologies and assumptions, including anticipated fleet mix changes and other trends in the aviation industry. It should also report on the following:

A-12

- Compare 2011 operations to historic trends (to 2000) and forecasts for planning horizon year 2030;
- Present updated forecasts of Logan Airport's passenger volume, aircraft operations, and fleet mix; and
- Compare forecast activity levels to historic trends, prior Logan Airport forecasts, and Federal Aviation Administration (FAA) forecasts for Logan Airport and the U.S. industry.

In addition to reporting the analysis of major activity issues, I advise Massport to consider and attempt to address all comments related to activity levels in the 2010 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2010. It also describes known future planning, construction, and permitting activities. In 2010 Massport completed the permitting process for redeveloping the Southwest Service Area (SWSA), a new consolidated rental car facility (ConRAC). Construction of this project began in July 2010. In July 2009, the MEPA review process began for the Logan Runway Safety Area (RSA) Improvements Project at Runway Ends 33L and 22R. In July 2010, Massport filed a combined federal/state Draft EA/EIR and the Final EA/EIR on January 31, 2011. Construction of the Runway 33L RSA improvements commenced in June 2011. In 2010 MEPA review was completed on the Green Bus Depot, a bus maintenance facility for Massport's clean fuel fleet buses in the North Service Area (NSA). The Green Bus Depot will be used to maintain the expanded shuttle bus fleet that will replace the Airport's aging compressed natural gas (CNG) bus fleet and the rental car company diesel shuttle buses. Construction of this project began in 2011.

The 2010 EDR reports multiple projects in the planning and design phase. Planning for the East Boston-Chelsea Bypass project commenced to develop a limited access roadway between Logan Airport and the new Chelsea Street Bridge. The Bypass roadway is expected to improve commercial vehicle access to the Airport, as well as reduce congestion on local East

Boston streets in the vicinity of Day Square, Eagle Square, and the Neptune Road corridor by directing airport-related commercial traffic to the new Bypass roadway. Massport filed an ENF on October 15, 2010, for which I determined that no further MEPA review was required. Construction is underway as of 2011. Massport also initiated planning for the Logan Airport Parking Deck Project (Economy Garage) along Prescott Street in the North Cargo Area (NCA) in 2010. The project was not subject to MEPA review and construction of the economy garage began in summer of 2010 and was completed and fully opened to the public in early 2011. Massport installed solar panel "trees" on the roof of the parking deck, and energy-efficient lighting throughout.

In the 2010 EDR, Massport also discusses completing the North Service Area (NSA) Roadway Corridor Project with final landscaping in 2011, which is a project to unify the existing roadway with new landscape. Construction of the NSA Roadway Corridor Project also began in 2010. Architectural design also commenced in December 2010 for two hangar upgrades in the NCA. In addition, Terminal B Garage repair and rehabilitation continued in 2010 where 32 solar panel trees (200 kilowatt (kW)) were installed on the top floor and the entire garage was fitted with high efficiency Light-Emitting Diode (LED) lighting. Taxiway G realignment construction was completed in 2010.

A-13 The 2011 ESPR should continue to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport must accommodate and guide tenant development. The ESPR should describe the status of planning initiatives for the following areas:

- Roadway Corridor Project;
- Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

A-14 The 2011 ESPR should also indicate the status of long-range planning activities, including the status of public works projects implemented by other agencies within the boundaries of Logan Airport. **A-15** The ESPR should also indicate the status and effectiveness of ground access changes, including roadway and parking projects, that consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on streets in adjacent neighborhoods.

Regional Transportation

In general, the 2010 EDR has met the requirements with respect to regional transportation issues. It describes activity levels at New England's regional airports in 2010 and updates recent

planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2010 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions.

The total number of air passengers utilizing New England's commercial service airports, including Logan Airport, increased from 42.0 million in 2009 to 43.1 million annual air passengers, an increase of 2.5 percent in 2010. While Logan Airport passenger traffic grew, air passenger levels continued to decline at the other regional airports. Passenger levels at the regional airports declined by 5.2 percent in 2010, compared to an increase of 7.5 percent at Logan Airport. This was largely due to legacy carriers withdrawing from smaller secondary markets and reducing their use of small regional jets.

Aircraft operations in the New England region remained largely flat, increasing slightly by 0.7 percent, from 1.03 million operations in 2009 to 1.04 million operations in 2010. The 2010 EDR reports that commercial airline operations declined by 0.25 percent. General aviation and military flights increased by 1.9 percent and 4.7 percent respectively. For the 2011 ESPR, Massport should continue to engage in cooperative metropolitan planning efforts including GreenDOT and the Healthy Transportation Compact, and the Boston Metropolitan Planning Organization (Boston MPO). **A-16**

The directives in the last ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2010 EDR has performed this task.

The 2011 ESPR should describe Logan Airport's role in the region's intercity transportation system by reporting on the following: **A-17**

Regional Airports

- 2011 regional airport operations, passenger activity levels, and schedule data within a historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Ground access improvements to the regional airports; and
- The role that Worcester Regional Airport and Hanscom Field play in the regional aviation system and Massport's efforts to promote these airports, including the updated 2030 forecasts for both airports.

Regional Transportation System **A-18**

- Overview of the restructured Massachusetts Department of Transportation (MassDOT) and Massport's role in managing regional transportation facilities;
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

Ground Transportation

The 2010 EDR reported on 2010 ground access conditions at the airport. This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2010. Specifically, the total number of annual air passengers at Logan Airport increased 7.5 percent to 27.4 million, compared to 25.5 million in 2009. During the same period, average daily traffic on airport roadways increased by 5.1 percent from 2009 to 2010, while vehicle miles traveled (VMT) at the Airport increased by 4.8 percent. The number of vehicles parked at the Airport increased by four percent from 2009 to 2010. As stated previously, Massport began construction of the Logan Airport Parking Deck Project, located on the 1,000-space Economy Lot in the NCA. It consolidates an additional 2,000 commercial parking spaces from various on-airport temporary commercial parking lots into a single structured parking facility containing approximately 3,000 commercial parking spaces. The garage maintains on-airport parking capacity in compliance with the limits imposed by the Logan Airport Parking Freeze. The garage was fully opened in March 2011.

Ground access activity to Logan Airport generally increased for all travel modes from 2009 to 2010. In 2010, Massport administered the periodic *Logan Airport Air Passenger Ground Access Survey* which indicates that mode shares for high-occupancy vehicles (HOV) to the Airport have returned to 2004 levels (30 percent HOV mode share) after having decreased by two percent in the *2007 Air Passenger Ground Access Survey*. MBTA Silver Line boardings at the Airport continued to grow, increasing by five percent in 2010, while Blue Line boardings at Airport Station decreased slightly compared to 2009. In 2010, ridership on water transportation to the Airport increased by about one percent in comparison to the previous year. Limousine ridership increased by an estimated 16 percent, and taxi dispatches increased 12 percent from 2009 to 2010. In 2010, Logan Express air passenger ridership increased by about one percent compared to 2009 levels, whereas employee use of Logan Express increased by four percent, and accounts for 42 percent of the service's ridership.

A-19

The 2011 ESPR should report on 2011 ground access conditions at the airport and provide a comparison of 2011 findings to those of 2010 for the following:

- Detailed description of compliance with Logan Airport Parking Freeze;
- High-occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Water Transportation, and Logan Express);
- Logan Airport Employee Transportation Management Association (Logan TMA) services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT);
- Parking demand and management (including rates and duration statistics);
- Status of long-range ground access management strategy planning; and

- Results of the 2010 Logan Airport Air Passenger Survey. A-19 con't.

The chapter should present a discussion of analytical methodologies and assumptions for the planning horizon year (2030) for traffic volumes, on-airport vehicle miles traveled (VMT) and parking demand. A-20

The 2011 ESPR should present a discussion of the following topics:

- Massport's target HOV mode share along with incentives;
- Non-Airport through-traffic;
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line, Silver Line, Water Transportation, and Logan Express;
- Report on Logan Express usage and efforts to increase capacity and usage;
- Progress on enhancing water transportation to and from Logan Airport;
- Progress on rental car consolidation;
- Report on results of ground access study; and
- Strategies for enhancing services and increasing employee membership in the Logan Airport TMA.

Noise

The EDR updates the status of the noise environment at Logan Airport in 2010, and describes Massport's efforts to reduce noise levels. The technical appendix contains useful and detailed information, while the main document provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring. The future 2011 ESPR represents an appropriate forum to serve this updating function.

The 2010 Day-Night Sound Level (DNL) contours are similar in size compared to 2009. The DNL 65 decibel (dB) contour remained the same in Revere and in most of Winthrop. The extent of the DNL 65 dB contour decreased slightly in the Point Shirley section of Winthrop due to the reduced number of departures from Runway 9 and the reduced number of aircraft arrivals over South Boston and East Boston. The geographic extent of the DNL 65 dB contour, however, did increase in East Boston near the Airport and over Boston Harbor due to an increase in departures from Runway 15R.

The 2010 EDR also reported on the findings of the Integrated Noise Model's (INM) results of the population impacted by airport noise and used both the 2010 and 2000 U.S. Census data as a basis for comparison. Using the 2000 Census, the overall number of people exposed to values greater than DNL 65 dB decreased by 11 percent in 2010, compared to 2009. An estimated 3,870 people were exposed to levels greater than DNL 65 dB as depicted in the 2010 contour, compared to 4,335 in 2009. This is the first time that the number of people exposed to the DNL 65 dB noise level has been fewer than 4,000 and that the number of people within the

DNL 65 dB in Boston has dropped below 1,000 to 711 people. Also the total population exposed to noise levels greater than DNL 70 dB decreased in 2010 compared to 2009. In 2009, the total population exposed to greater than DNL 70 dB was 243, and in 2010 the number dropped to 198.

The 2010 EDR also reports that in 2010, Massport provided sound insulation to 83 homes, nearly half of which are in Chelsea. The focus of this program in Chelsea was to fulfill federal and state mitigation commitments related to the opening of Runway 14-32. Since the inception of Massport's Sound Insulation program, 11,219 homes have received sound insulation treatment in East Boston, South Boston, Winthrop, Revere, and Chelsea.

A-21 The information in this chapter is very informative and I encourage Massport to continue with more detailed analysis in the 2011 ESPR. I strongly advise Massport to consider and address the comments received that have raised noise related concerns. The comments from the City of Cambridge, as well as from individuals have raised a number of concerns and suggestions related to noise that Massport should address into the 2011 ESPR.

A-22 The 2011 ESPR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, the methodologies used to track noise, and any changes in noise modeling. A-23 The chapter must report on 2011 conditions and compare 2011 conditions to those of 2010 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) tracking; and
- Flight tracks.

A-24 The chapter must report on 2011 conditions and compare those to 2010 conditions for the following noise indicators:

- Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM) produce an accurate set of Day-Night Sound Level (DNL) noise contours;
- Noise-impacted population (using the 2010 Census data);
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of most current version of the Integrated Noise Model (INM);
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels;
- Installation and benefits of the new noise monitoring system; and
- Flight track monitoring noise quarterly reports.

The chapter should report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide a status update on the new noise and operations monitoring system. This chapter should also present a discussion of analysis methodologies and assumptions, including fleet mix and runway use assumptions, and report on future year conditions for 2030 for the following noise indicators: A-25 A-26

- Runway utilization;
- DNL noise contours; and
- Population counts.

The chapter should also report on noise abatement efforts and provide a status update on any new noise and operations monitoring system. At the public meeting held on November 16, 2011, several residents of the Point of Pines section of Revere requested that their homes be included in Massport's Residential Sound Insulation Program (RSIP). As discussed at the public meeting and shown in the 2010 EDR, Point of Pines falls outside the 60 DNL contour, and, therefore, is ineligible for funding in the FAA's RSIP that begins at the 65 DNL contour. However, in response to a resident's and the City Council's request, Massport has already committed to conducting supplemental noise monitoring during 2012 in the Point of Pines area to validate the results of the permanent noise monitor (Carey Circle, #17) in that section of Revere. The results of that analysis should be reported in the 2011 ESPR. A-27

<u>Air Quality</u>

The 2010 EDR provides an overview of airport-related air quality issues in 2010 and efforts to reduce emissions. The 2010 EDR reports that the total emissions of volatile organic compounds (VOC) were 1,019 kilograms per day (kg/day). This number is four percent higher than 2009 levels but is still following a long-term, downward trend decreasing by almost 78 percent since 1990. The increase is primarily due to the increase in landing and takeoff operations (LTOs) when compared to 2009. The total emissions of oxides of nitrogen (NOX) were 3,989 kg/day, or less than one percent higher than 2009 levels. In 2010, total NOx emissions at Logan Airport (net total with reductions) were approximately 742 tons per year (tpy) lower than Massport's 1999 Air Quality Initiative (AQI) benchmark. This represents a 32 percent decrease in NOx emissions since 1999. The total emissions of carbon monoxide (CO) were 7,160 kg/day, or 10 percent lower than 2009 levels. Due to the decreased use of No. 6 fuel oil, total emissions of particulate matter (PM) PM10/PM2.5 associated with Logan Airport heating and cooling decreased in 2010 by approximately 10 percent to 64 kg/day compared to 2009 levels.

The 2010 EDR reports that since 1999, there has been a continuing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the vicinity of Logan Airport. In addition, the annual NO2 concentrations at all monitoring locations in 2010 continued to be well within the National Ambient Air Quality Standards (NAAQS) for NO2. The 2010 EDR

also reported on Massport's two-phased Air Quality Monitoring Study that is collecting data on a variety of ambient air pollutants over a two year period and assessing air quality changes

A-28

attributable to the operation of the new centerfield taxiway. The second phase of the Study concluded in 2011, after the centerfield taxiway became fully operational. Massport will submit the findings from this study to MassDEP in late 2011 or early 2012. The results of this study should also be reported in the 2011 ESPR.

Massport prepared an inventory of greenhouse gas (GHG) emissions directly and indirectly associated with Logan Airport operations. The 2010 GHG emission inventory was updated incorporating guidance developed by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP). The ACRP guidance was published in April 2009 for airport operators to develop an airport-specific GHG emissions inventory. The 2010 inventory assigns emissions based on ownership or control (e.g., Massport, airlines and other airport tenants, and the general public). The vast majority of emission sources at Logan Airport are owned or controlled by the airlines, airport tenants, and the general public (through emissions from motor vehicles). According to the EDR, Massport sources contribute 12 percent of the total GHG emissions for the Airport. Total Logan Airport GHG emissions in 2010 were slightly lower (0.4 percent) than 2009 levels.

A-29

The 2011 ESPR should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The chapter should also discuss analytical methodologies and assumptions and report on 2011 conditions using the most recent versions of the Emissions Dispersion Modeling System (EDMS) and MOBILE motor vehicle emissions. The chapter should also include:

A-30

- Emissions inventory for carbon monoxide (CO);
- Emissions inventory for oxides of nitrogen (NOx);
- Emissions inventory for volatile organic compounds (VOCs);
- Emissions inventory for particulate matter (PM);
- Nitrogen dioxide (NO2) monitoring; and
- NOx emissions by airline.

A-31

This chapter must also report on the following air quality initiatives (AQI) for 2011:
- Air Quality Initiative Tracking;
- Massport's and Tenant's Alternative Fuel Vehicle Programs; and
- The status of Logan Airport air quality studies undertaken by Massport or others, as available.

A-32

The 2011 ESPR should also include an inventory of greenhouse gas (GHG) emissions from Logan Airport in 2011. GHG emissions should be quantified for aircraft, motor vehicles and stationary sources using emission factors and methodologies outlined in the *Greenhouse Gas Emissions Policy and Protocol* issued by EEA and the Transportation Research Board's

Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories (Airport Cooperative Research Program (ACRP) Report 11, Project 02-06). The results of the 2011 GHG emissions inventory should be compared to the 2010 results. A-32 con't.

The ESPR should also present a discussion of analytical methodologies and assumptions and report on future year condition for 2030 for the following air quality indicators: A-33

- Emissions Inventory for CO;
- Emissions Inventory for NOx;
- Emissions Inventory for VOCs; and
- Emissions Inventory for GHGs.

In a comment letter from Mr. Pomicter, there is a request for a program to encourage the use of single-engine taxiing and suggested that Massport has not fulfilled its Section 61 mitigation commitments associated with the Logan Airside Improvements Project (EOEA #10458), specifically related to single-engine taxi procedures. The ESPR should include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions. I encourage Massport to communicate with airlines regarding the use of single engine taxiing, when safe to do so, within the Logan Airport operational context. An update of this effort should be provided in the 2011 ESPR. A-34

The 2011 ESPR should also report on the status of the Logan Health Study, as requested by a commenter, which is currently underway by the Massachusetts Department of Public Health (DPH), portions of which were funded by Massport. This DPH study was initially fully funded by the Commonwealth, but was later cut by the legislature. Massport agreed to fund the shortfall for a total of $195,000. This sum was transferred to the Commonwealth/ DPH in December 2010 and that study is now progressing to completion. Massport should continue to provide data to DPH in support of this analysis. The commenter also questioned why the Commonwealth had not yet completed the legislated study of health effects of particulate air pollution (and specifically fine and ultrafine particulate matter) from surface and air transportation required by the Transportation Reform Act of 2009. Because there are presently no federal or state public health standards for ultrafine particulate matter, Massport committed to provide $150,000 to MassDOT in support of the scoping of the analyses called for in the Transportation Reform Act. The 2011 ESPR should provide more details on this commitment. A-35 A-36

Water Quality/Environmental Compliance

The 2010 EDR describes Massport's ongoing environmental management activities including National Pollutant Discharge Elimination System (NPDES) compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management. In accordance with the requirements of the current NPDES permit for Logan Airport that was issued on July 31, 2007, Massport and all 27 co-permittees and tenants began preparation of an updated Stormwater Pollution Prevention Plan (SWPPP). Massport completed its SWPPP in December

of 2007 and tenant SWPPPs were completed in March 2008. Massport's SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants.

In accordance with the Massachusetts Contingency Plan (MCP), the 2009 EDR reported that Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. The 2010 EDR states that Massport is working towards achieving regulatory closure of the remaining MCP sites. In addition, preparation of the Environmental Management System (EMS) for facilities where fleet and field maintenance activities are conducted was on-going in 2010.

In 2010, there were 15 oil and hazardous material spills that required reporting to MassDEP, five of which involved a storm drainage system. One outfall sample out of a total of 19 samples at the Maverick Street Outfall and one outfall sample out of a total of 23 samples at the North Outfall exceeded the regulatory limits of the NPDES permit for the North, West, and Maverick Street Outfalls. The 2010 EDR reports that these exceedances were reported during April and November of 2010, respectively, as required. The 2010 Annual Certificates of Compliance were submitted to the U.S. Environmental Protection Agency (EPA) and MassDEP on December 21, 2010, for Massport and each tenant co-permittee.

A-37 The 2011 ESPR should report on the 2010 status of:

- NPDES Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility;
- Jet fuel usage and spills;
- Massachusetts Contingency Plan (MCP) activities;
- Tank management;
- Update of the environmental management plan; and
- Fuel spill prevention.

A-38 The chapter should also present a discussion of the following topics:

- Future stormwater management improvements (if any) ; and
- Future MCP and tank management activities.

Massport should continue to report in the 2011 ESPR how it will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Sustainability at Logan Airport

This chapter describes Massport's airport-wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy that articulates Massport's commitment to protect the environment and to implement sustainable design

principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision. It also identifies the actions necessary to achieve the goals, the staff members responsible for each sustainability goal, and the timeline for achieving the goals. The short-term goals set out in the Sustainability Plan were described in the 2010 EDR. Massport participated in the 2010 Environmental Benchmarking Survey sponsored by Airports Council International-North America (ACI-NA) to assess solar power, purchase of renewable energy, availability of low-emission ground transportation, recycling, and environmentally preferred purchasing.

The EDR describes Massport's continued sustainability efforts and details how sustainability is incorporated into many aspects of Massport's activities. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2011 ESPR. The 2011 ESPR should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have commenced construction. The mitigation commitments were made in the Section 61 Findings for the following projects which should be reported: A-39 A-40

- West Garage/Central Garage;
- International Gateway;
- Runway Ends 22R and 33L Runway Safety Area Improvements;
- Replacement Terminal A;
- Logan Airside Improvements Planning; and
- Southwest Service Area Redevelopment Program.

The 2011 ESPR should also update the status of Massport's mitigation commitments and also identify projects for which mitigation measures have been completed.

Distribution of the 2011 ESPR

Several commenters have requested more timely filings of future EDRs and the forthcoming 2011 ESPR and other information related to the airport. Massport should explore opportunities to advance the reporting of information through Massport's website. Massport should strive to collect and analyze the information required for the 2011 ESPR and report this information in a timely manner. Many commenters have suggested ways to improve the text, maps and graphics and Massport should consider those changes for future filings. For several recent projects, Massport has published bi-lingual meeting and project notices and made the services of an interpreter available upon request. Massport should consider continuing these services for the 2011 ESPR and future EDR submittals. A-41 A-42 A-43

Conclusion

I have determined that the 2010 EDR for Logan Airport has adequately complied with MEPA and that Massport must submit a 2011 ESPR that responds to the issues raised in

A-44 comments received. The 2011 ESPR must include a copy of this Certificate and a copy of each comment letter received on the 2010 EDR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, noise abatement, and air quality issues.

December 16, 2011
Date

for Richard K. Sullivan Jr.

Comments Received:

12/09/2011	Air, Inc.
12/09/2011	City of Cambridge, Executive Department
12/09/2011	Nancy Timmerman
12/09/2011	Stephen Kaiser, PhD
12/09/2011	Darryl Pomicter
12/15/2011	Boston Transportation Department
12/15/2011	The Boston Harbor Association
12/15/2011	City of Boston Environment Department

RKS/ACC/acc

Comment #	Author	Topic	Comment	Response
A.1	Richard K. Sullivan, Jr., Secretary	Noise	The majority of comments received on the EDR focused on noise issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2011 ESPR and future EDRs should also report on the progress and other refinements for tracking noise and abatement efforts, as further described in the Scope for the 2011 ESPR below.	Information on noise and on-going improvements to address noise issues are provided in *Chapter 6, Noise Abatement* of this *2011 Logan Airport Environmental Status and Planning Report (2011 ESPR).*
A.2	Richard K. Sullivan, Jr., Secretary	MEPA	The 2011 ESPR should follow the general format of the 2004 ESPR, presenting major policy discussions and an overview of the role of Logan Airport in the regional planning context. This should be followed by a status report on Massport's planning initiatives, projects, and mitigation measures. The ESPR should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs. Massport must provide necessary background information to allow reviewing agencies and the public to understand the environmental policies and planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport.	The *2011 ESPR* follows the same general format the *2004 ESPR*. The *2011 ESPR* presents major policy discussions and provides an overview of the role of Logan Airport within the region. Included in the *2011 ESPR* is a status update on planning initiatives, projects, and mitigation initiatives. Refer to *Chapter 3, Airport Planning,* and *Chapter 9, Project Mitigation Tracking.* To enhance review of this *2011 ESPR,* necessary background information is provided in the main chapters and supporting technical appendices of this document.
A.3	Richard K. Sullivan, Jr., Secretary	Activity Levels	The 2011 ESPR should report on updated passenger and operations activity forecasts for Logan Airport and Massport's other airports, Hanscom Field and Worcester Regional Airport. The new forecast used should begin with 2011 as the base year and project activity forecasts forward to calendar year 2030.	*Chapter 2, Activity Levels,* reports on updates passenger and operation activity forecasts for Logan Airport and the other Massport airports. The new forecast includes 2011 as the current reporting year and provides passenger, aircraft and cargo activity levels for the forecast horizon year of 2030.
A.4	Richard K. Sullivan, Jr., Secretary	Ground Access	In addition, the 2011 ESPR should use the results of the 2010 Logan Airport Air Passenger Survey and the findings of the Sustainable Ground Access Strategy and Service Plan effort to inform future access planning.	The results from the *2010 Logan Airport Air Passenger Survey* and the *Sustainable Ground Access Strategy and Service Plan* are an important data source for Massport and are used to inform Massport's planning for ground access to and from the airport. See *Chapter 5, Ground Access to and from Logan Airport.*

Comment #	Author	Topic	Comment	Response
A.5	Richard K. Sullivan, Jr., Secretary	MEPA	The technical studies in the 2011 ESPR should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2011 ESPR must also respond to those issues explicitly noted in this Certificate and the comments received on the 2010 EDR.	The *2011 ESPR* reports on the technical studies outlined in the Secretary's Certificate. *Chapter 2, Activity Levels,* reports on and analyzes the airport activity levels, and provides a new future forecast for 2030. The regional transportation system is presented in *Chapter 4, Regional Transportation. Chapter 5, Ground Access to and from Logan Airport,* provides information on ground access. *Chapter 6, Noise Abatement,* reports on and analyzes noise. *Chapter 7, Air Quality/Emissions Reduction*, reports on and analyzes air quality. Environmental management and water quality is reported on and analyzed in *Chapter 8, Water Quality/ Environmental Compliance and Management. Chapter 9, Project Mitigation Tracking,* provides project mitigation tracking. Finally, this appendix and *Appendix B, Comment Letters and Responses,* provides responses to comments in the Certificate and other comment letters.
A.6	Richard K. Sullivan, Jr., Secretary	MEPA	A distribution list for the 2011 ESPR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document.	The distribution list for the *2011 ESPR* is provided in *Appendix D, Distribution.*
A.7	Richard K. Sullivan, Jr., Secretary	MEPA	This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan Environmental Status and Planning Report (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary.	The ESPR and EDR certificates for previous reporting years back to 2004 are provided in *Appendix A, MEPA Certificates and Responses to Comments.* Supporting technical appendices are provided as necessary.
A.8	Richard K. Sullivan, Jr., Secretary	MEPA	The 2011 ESPR must include responses to comments that address all of the substantive comments from the letters listed at the end of this Certificate.	Individual responses to comments are provided in *Appendix B, Comment Letters and Responses,* of the *2011 ESPR.*
A.9	Richard K. Sullivan, Jr., Secretary	Noise	In addition to responding to these comments, the 2011 ESPR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commenters where appropriate.	*Chapter 6, Noise Abatement,* provides information on the requested topics. All comments have been addressed in Appendices A and B of the *2011 ESPR*.
A.10	Richard K. Sullivan, Jr., Secretary	Activity Levels	The 2011 ESPR must report on airport activity levels, including information on aircraft operations, including fleet mix, passenger activity levels, and cargo and mail operations. It should also report on Massport's activity level forecasts that will become the basis for the planning and impact sections that follow and for Massport's strategic planning initiatives over the next few years.	This *2011 ESPR* includes a report on national aviation trends since 2000 and provides an overview of the significant changes in the airport industry since that time. Recent trends are discussed and the chapter provides forecasts of aircraft operations (including a likely fleet mix) passenger activity levels, and cargo and mail operations for 2030. See *Chapter 2, Activity Levels.*

Comment #	Author	Topic	Comment	Response
A.11	Richard K. Sullivan, Jr., Secretary	Activity Levels	For the 2011 ESPR, the Activity Levels chapter should include: aircraft operations, including fleet mix and scheduled airline services at Logan Airport; passenger activity levels; cargo and mail activities; a compare the 2011 aircraft operations, cargo/mail operations, and passenger activity levels to 2010 activity levels; and a report on national aviation trends in 2011 and a comparison to trends at Logan Airport.	See the response to Comment A.10.
A.12	Richard K. Sullivan, Jr., Secretary	Activity Levels	It should also report on Massport's forecasts that become the basis for the planning and impact sections that follow and for Massport's planning initiatives over the next five years. Future year analyses should be based on the 2030 forecast. It should update the aircraft operations and passenger activity forecasts, and provide a discussion of analysis methodologies and assumptions, including anticipated fleet mix changes and other trends in the aviation industry. It should also report on the following: compare 2011 operations to historic trends (to 2000) and forecasts for planning horizon year 2030; present updated forecasts Logan Airport's passenger volumes, aircraft operations, and fleet mix; and compare forecast activity levels to historic trends, prior Logan Airport forecasts, and Federal Aviation Administration (FAA) forecasts for Logan Airport and the US industry.	*Chapter 2, Activity Levels,* reports on Massport's forecasts that have become the basis for planning. The Chapter also reports on the 2030 forecast. Specifically, *Chapter 2, Activity Levels* compares the 2011 operations to historic trends and the forecasts for 2030. The chapter presents 2011 and 2030 passenger volumes, aircraft operations, and fleet mix; and compares forecast activity levels to historic presents, prior Logan Airport forecasts, and FAA forecasts for Logan Airport and the U.S. aviation industry.
A.13	Richard K. Sullivan, Jr., Secretary	Airport Planning	The 2011 ESPR should continue to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport must accommodate and guide tenant development. The ESPR should describe the status of planning initiatives for the following areas: Roadway Corridor Projects; Airport Parking; Terminal Area; Airside Area; Service and Cargo Areas; and Airport Buffers and Landscaping.	As part of planning for the safe and efficient operation of Logan Airport, Massport is mindful of environmental concerns and seeks to reduce the environmental impacts associated with Logan Airport activities. Updates on the status of the roadway corridor projects, Airport Parking, Terminal Area, Airside Area, Service and Cargo Areas, and Airport Buffers and Landscaping are provided in *Chapter 3, Airport Planning.* Additional information is also provided in *Chapter 5, Ground Access to and from Logan Airport.*
A.14	Richard K. Sullivan, Jr., Secretary	Airport Planning	The 2011 ESPR should also indicate the status of long-range planning activities, including the status of public works projects implemented by other agencies within the boundaries of Logan Airport.	The *2011 ESPR* reports on the status of long-range planning activities in *Chapter 4, Regional Transportation.*
A.15	Richard K. Sullivan, Jr., Secretary	Ground Access	The ESPR should also indicate the status and effectiveness of ground access changes, including roadway and parking projects, that consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on streets in adjacent neighborhoods.	*Chapter 5, Ground Access to and from Logan Airport,* reports on the status and effectiveness of ground access changes that have consolidated and directed airport-related traffic to centralized locations minimizing the amount of airport-related traffic in adjacent neighborhoods.

Comment #	Author	Topic	Comment	Response
A.16	Richard K. Sullivan, Jr., Secretary	Regional Transportation	For the 2011 ESPR, Massport should continue to engage in cooperative metropolitan planning efforts including GreenDOT and the Healthy Transportation Compact, and the Boston Metropolitan Planning Organization (Boston MPO).	The *2011 ESPR* describes Massport collaboration with other regional transportation organizations in planning for the region's transportation needs. See *Chapter 4, Regional Transportation*
A.17	Richard K. Sullivan, Jr., Secretary	Activity Levels	The 2011 ESPR should describe Logan Airport's role in the region's intercity transportation system by reporting on the following related to Regional Airports and Regional Transportation System: *Regional Airports* : 2010 regional airport operations, passenger activity levels, and schedule data within an historical context; status of plans and new improvements as provided by the regional airport authorities; ground access improvements to the regional airports; and the role that Worcester Regional Airport and Hanscom Field play in the regional aviation system and Massport's efforts to promote these airports.	The *2011 ESPR* reports on Massport's efforts to strengthen the regional transportation system; the agency's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and metropolitan and regional rail initiatives and ridership. See C*hapter 4, Regional Transportation.*
A.18	Richard K. Sullivan, Jr., Secretary	Regional Transportation	The 2011 ESPR should describe Logan Airport's role in the region's intercity transportation system by reporting on the following related to Regional Airports and Regional Transportation System: *Regional Transportation System:* Massport's efforts in strengthening the regional transportation system; Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and report on metropolitan and regional rail initiatives and ridership.	See the response to Comment A.17.
A.19	Richard K. Sullivan, Jr., Secretary	Ground Access	The 2011 ESPR should report on 2011 ground access conditions at the airport and provide a comparison of2011 findings to those of 2010 for the following: detailed description of compliance with the Logan Airport Parking Freeze; high occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Scheduled, Unscheduled, Water Transportation, and Logan Express); Logan Airport Employee Transportation Management Association (Logan TMA) membership and services; Logan Airport gateway volumes; on-airport traffic volumes; on-airport vehicle miles traveled (VMT); parking demand and management (including rates and duration statistics); parking demand and management (including rates and duration statistics; status of long-range ground access management strategy planning; and results of 2010 Logan Airport Air Passenger Survey.	*Chapter 5, Ground Access to and from Logan Airport,* reports on 2011 conditions and compares 2011 findings to those of 2010: for parking levels, HOV ridership, Logan TMA, Logan gateway volumes, on-airport traffic volumes, on-airport VMT, parking demand and management, and a status of long-range ground access management strategy planning. The results of the *2010 Logan Airport Air Passenger Survey* were reported in the *2010 EDR.*

Comment #	Author	Topic	Comment	Response
A.20	Richard K. Sullivan, Jr., Secretary	Ground Access	The chapter should present a discussion of analytical methodologies and assumptions for the planning horizon year (2030) for traffic volumes, on-airport vehicle miles traveled (VMT) and parking demand. The 2011 ESPR should present a discussion of the following topics: Massport's target HOV mode share along with incentives; non-airport thru-traffic; Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line, Silver Line, Water Transportation, and Logan Express; report on Logan Express usage and efforts to increase capacity and usage; progress on enhancing water transportation to and from Logan Airport; progress on rental car consolidation; report on results of ground access study; and strategies for enhancing services and increasing employee membership in the Logan Airport TMA.	This *2011 ESPR* uses an updated ground traffic analysis model - called VISSIM, which provides finer-grained information on the airport roadway system. This will enhance Massport's planning capabilities. A discussion of the analytical methodologies and assumptions for the 2030 traffic volumes, on-airport VMT, and parking demand is provided in the *Chapter 5, Ground Access to and from Logan Airport.* Massport continues to make strides in improving ground access options to and from Logan Airport. The additional requested information is provided in *Chapter 5, Ground Access to and from Logan Airport* .
A.21	Richard K. Sullivan, Jr., Secretary	Noise	The information in this chapter is very informative and I encourage Massport to continue with more detailed analysis in the 2011 ESPR. I strongly advise Massport to consider and address the comments received that have raised noise related concerns. The comments from the City of Cambridge, as well as from individuals have raised a number of concerns and suggestions related to noise that Massport should address into the 2011 ESPR.	Information on noise is provided in *Chapter 6, Noise Abatement,* of this *2011 ESPR.* All comments have been addressed in *Appendices A and B* of the *2011 ESPR.*
A.22	Richard K. Sullivan, Jr., Secretary	Noise	The 2011 ESPR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, the methodologies used to track noise, and any changes in noise modeling.	*Chapter 6, Noise Abatement,* provides information on the requested topics.
A.23	Richard K. Sullivan, Jr., Secretary	Noise	The chapter must report on 2011 conditions and compare 2011 conditions to those of 2010 for the following: fleet mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and any qualifying Stage IV aircraft; nighttime operations; runway utilization (report on aircraft and airline adherence with runway utilization goals; Preferential runway advisory system (PRAS) compliance; and flight tracks.	Massport reports on 2011 conditions and compares them to those of 2010 for the following: fleet mix including: Stage II, Recertified Stage II, newly manufactured Stage III, and qualifying Stage IV aircraft; nighttime operations; runway utilization; PRAS compliance; and flight tracks. See *Chapter 6, Noise Abatement.*

Comment #	Author	Topic	Comment	Response
A.24	Richard K. Sullivan, Jr., Secretary	Noise	The chapter must report on 2011 conditions and compare those to 2010 conditions for the following noise indicators: Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM) produce an accurate set of Day-Night Sound Level (DNL) noise contours; Noise-impacted population (using the 2010 Census data); Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of most current version of the Integrated Noise Model (INM); Cumulative Noise Index (CNI); Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels; Installation and benefits of the new noise monitoring system; and Flight track monitoring noise quarterly reports.	The *2011 ESPR* reports on 2011 conditions and compares them to those of 2010 for the following noise parameters: DNL noise contours, noise impacted population, measured versus modeled noise values, CNI, Times-Above for 65,75, 85 dBA threshold values, noise monitoring system status, and flight track monitoring reports. See *Chapter 6, Noise Abatement.*
A.25	Richard K. Sullivan, Jr., Secretary	Noise	The chapter should report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide a status update on the new noise and operations monitoring system.	Noise abatement efforts, including results from the BLANS, and the noise and operations monitoring system updates are provided in *Chapter 6, Noise Abatement.*
A.26	Richard K. Sullivan, Jr., Secretary	Noise	This chapter should also present a discussion of analysis methodologies and assumptions, including fleet mix and runway use assumptions, and report on future year conditions for 2030 for the following noise indicators: runway utilization; DNL noise contours; and population counts.	*Chapter 6, Noise Abatement,* presents a discussion of the analysis methodologies and assumptions and reports on 2030 conditions for runway utilization, DNL noise contours, and population counts.
A.27	Richard K. Sullivan, Jr., Secretary	Noise	As discussed at the public meeting and shown in the 2010 EDR, Point of Pines falls outside the 60 DNL contour, and, therefore, is ineligible for funding in the FAA's RSIP that begins at the 65 DNL contour. However, in response to a resident's and the City Council's request, Massport has already committed to conducting supplemental noise monitoring during 2012 in the Point of Pines area to validate the results of the permanent noise monitor (Carey Circle, #17) in that section of Revere. The results of that analysis should be reported in the 2011 ESPR.	The Revere monitoring study for the Point of Pines Neighborhood is currently being coordinated with local residents regarding choosing a specific site and time frame for the study. *Chapter 6, Noise Abatement,* does provide data on Revere and the noise contours do reflect the flight tracks and runway use impacting the Point of Pines neighborhood.
A.28	Richard K. Sullivan, Jr., Secretary	Air Quality	The second phase of the [Air Quality Monitoring Study] concluded in 2011, after the centerfield taxiway became fully operational. Massport will submit the findings from this study to MassDEP in late 2011 or early 2012. The results of this study should also be reported in the 2011 ESPR.	The Centerfield Taxiway Air Toxics study concluded the data collection phase in September 2011. The final report, including study results and evaluation are expected to be released in 2013. A public meeting will be scheduled to discuss results with members of the public once the report is completed.

Comment #	Author	Topic	Comment	Response
A.29	Richard K. Sullivan, Jr., Secretary	Air Quality	The 2011 ESPR should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The chapter should also discuss analytical methodologies and assumptions and report on 2011 conditions using the most recent versions of the Emissions Dispersion Modeling System (EDMS) and MOBILE motor vehicle emissions.	The *2011 ESPR* reports on modeled air quality using EDMS and MOBILE motor vehicle emissions models to model carbon monoxide (CO), nitrogen oxides (NOx), volatile organic compounds (VOCs), and particulate matter (PM). In addition, Massport modeled NOx emissions by airline. *Chapter 7, Air Quality/Emissions Reduction,* reports on the model updates to EDMS and MOBILE and uses the most recent versions of the models to assess air quality conditions.
A.30	Richard K. Sullivan, Jr., Secretary	Air Quality	The chapter should also include: emissions inventory for carbon monoxide (CO); emissions inventory for oxides of nitrogen (NOx); emissions inventory for volatile organic compounds (VOCs); emission inventory for particulate matter (PM); nitrogen dioxide (NO2) monitoring; and NOx emissions by airline.	*Chapter 7, Air Quality/Emissions Reduction,* of this *2011 ESPR* includes emissions inventories for CO, NOx, VOC, PM, NO2 monitoring, and NOx emissions by airline.
A.31	Richard K. Sullivan, Jr., Secretary	Air Quality	This chapter should also report on the following air quality initiatives (AQI) for 2011: Air Quality Initiative Tracking; Massport's and Tenant's Alternative Fuel Vehicle Programs; and the status of other Logan Airport air quality studies undertaken by Massport or others, as available.	The *2011 ESPR* reports on the air quality initiative tracking, Massport's and tenant's alternative fuel vehicle programs; and the status of other air quality studies. See *Chapter 7, Air Quality/Emissions Reduction.*
A.32	Richard K. Sullivan, Jr., Secretary	Air Quality	The 2011 ESPR should also include an inventory of greenhouse gas (GHG) emissions from Logan Airport in 2011. GHG emissions should be quantified for aircraft, motor vehicles and stationary sources using emission factors and methodologies outlined in the *Greenhouse Gas Emissions Policy and Protocol* issued by EEA and the Transportation Research Board's *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories* (Airport Cooperative Research Program (ACRP) Report 11, Project 02-06). The results of the 2011 GHG emissions inventory should be compared to the 2010 results.	*Chapter 7, Air Quality/Emissions Reduction,* of this *2011 ESPR* includes a report on greenhouse gas (GHG) emissions at Logan Airport in 2011 and compares it to 2010 levels. The GHG emissions are quantified for aircraft, ground access equipment (GSE), motor vehicles, stationary sources, and electrical usage. The methodologies deployed follow Executive Office of Energy and Environmental Affairs (EOEEA) and ACRP guidelines.
A.33	Richard K. Sullivan, Jr., Secretary	Air Quality	The ESPR should also present a discussion of analytical methodologies and assumptions and report on future year condition for 2030 for the following air quality indicators: emissions inventory for carbon monoxide (CO); emissions inventory for oxides of nitrogen (NOx); emissions inventory for volatile organic compounds (VOCs); and emissions inventory for greenhouse gases (GHG).	*Chapter 7, Air Quality/Emissions Reduction,* of this *2011 ESPR* includes emissions inventories for CO, NOx, VOC, and GHG for 2030.
A.34	Richard K. Sullivan, Jr., Secretary	Air Quality	The ESPR should include an update on Massport' s efforts to encourage the use of single engine taxiing under safe conditions. I encourage Massport to communicate with airlines regarding the use of single engine taxiing, when safe to do so, within the Logan Airport operational context. An update of this effort should be provided in the 2011 ESPR.	The *2011 ESPR* provides an update on the efforts that Massport has undertaken to encourage the use of single engine taxiing. Refer to *Chapter 7, Air Quality/Emissions Reduction.*

Comment #	Author	Topic	Comment	Response
A.35	Richard K. Sullivan, Jr., Secretary	Air Quality	The 2011 ESPR should also report on the status of the Logan Health Study, as requested by a commenter, which is currently underway by the Massachusetts Department of Public Health (DPH), portions of which were funded by Massport.	Per verbal communication with the DPH Project Manager, Margaret Round and Commissioner , Suzanne Condon on 9/7/2012, DPH intends to send the report out for scientific peer review in 2012. A schedule for final issuance of the report will depend on the extent of peer review comments received.
A.36	Richard K. Sullivan, Jr., Secretary	Air Quality	Because there are presently no federal or state public health standards for ultrafine particulate matter, Massport committed to provide $150,000 to MassDOT in support of the scoping of the analyses called for in the Transportation Reform Act. The 2011 ESPR should provide more details on this commitment.	The Massachusetts Department of Transportation (MassDOT) is developing a response to the analysis called for in the Transportation Reform Act. Massport will fund up to $150,000 once the format and scope of the study is developed.
A.37	Richard K. Sullivan, Jr., Secretary	Water Quality	For 2011, the Water Quality/Environmental Compliance and Management chapter should report on the 2010 status of: the National Pollutant Discharge Elimination System (NPDES) Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility; jet fuel usage and spills; Massachusetts Contingency Plan (MCP) activities; tank management; update on Environmental Management Plan; and fuel spill prevention.	These water quality and environmental compliance activities are reported in *Chapter 8, Water Quality/ Environmental Compliance and Management.*
A.38	Richard K. Sullivan, Jr., Secretary	Water Quality	The chapter should also present a discussion of the following topics: future stormwater management improvements (if any); and future MCP and tank management activities. Massport should continue to report in the 2011 ESPR how it will assess, remediate, and bring to regulatory closure areas of subsurface contamination.	Massport and its tenants continue to make progress on bringing various sites to regulatory closure. These and other water quality/ environmental compliance activities are reported in *Chapter 8, Water Quality/ Environmental Compliance and Management.*
A.39	Richard K. Sullivan, Jr., Secretary	Sustainability	The EDR describes Massport's continued sustainability efforts and details how sustainability is incorporated into many aspects of Massport's activities. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2011 ESPR.	These sustainability efforts are reported in *Chapter 1, Introduction/Executive Summary.*
A.40	Richard K. Sullivan, Jr., Secretary	Mitigation	The 2011 ESPR should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have commenced construction. The mitigation commitments were made in the Section 61 findings for the following projects which should be reported: West Garage/Central Garage; International Gateway; Runway Ends 22R and 33L Safety Improvements; Replacement Terminal A; Logan Airside Improvements Planning; and Southwest Service Area Redevelopment Program. The 2011 ESPR should also update the status of Massport' s mitigation commitments and also identify projects for which mitigation measures have been completed.	The status of these mitigation efforts is reported in *Chapter 9, Project Mitigation Tracking.*

Comment #	Author	Topic	Comment	Response
A.41	Richard K. Sullivan, Jr., Secretary	MEPA	Massport should explore opportunities to advance the reporting of information through Massport's website. Massport should strive to collect and analyze the information required for the 2011 ESPR and report this information in a timely manner.	Massport published advance information in October 2012 to provide reviewers with a preview of the data reported on in the *2011 ESPR.* Massport is continuing to explore opportunities to enhance the reporting of information on the website (http://www.massport.com/environment/Pages/Default.aspx). Currently, a visitor to Massport's environmental website could find information on green initiatives at Massport facilities, Massport's achievements in environmental efforts, Massport's environmental management policy, environmental reporting, and related links.
A.42	Richard K. Sullivan, Jr., Secretary	General	Many commenters have suggested ways to improve the text, maps and graphics and Massport should consider those changes for future filings.	Massport continually works to improve the text, maps, and graphics in all of their filings, including the EDRs and ESPRs. A few examples of improvements in this *2011 ESPR* are: a new Noise introduction section in Appendix H to give the lay reader an easy to understand description of key noise issues and terms and a new aerial graphic in Chapter 5, Ground Access, that shows the historical changes to the Logan Airport road network over time.
A.43	Richard K. Sullivan, Jr., Secretary	MEPA	For several recent projects, Massport has published bi-lingual meeting and project notices and made the services of an interpreter available upon request. Massport should consider continuing these services for the 2011 ESPR and future EDR submittals.	Massport will publish bilingual meeting and project notices and will make the services of an interpreter available upon request for the *2011 ESPR* and future EDR and ESPR filings.
A.44	Richard K. Sullivan, Jr., Secretary	MEPA	The 2011 ESPR must include a copy of this Certificate and a copy of each comment letter received on the 2010 EDR.	Individual responses to comments are provided in this *Appendix A* and as well as *Appendix B* of this *2011 ESPR.*

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Copies of Secretary of the Executive Office of Energy and Environmental Affairs Certificates issued for the Reporting Years 2004, 2005, 2006, 2007, 2008, and 2009

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August 16, 2006

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
ENVIRONMENTAL STATUS AND PLANNING REPORT

PROJECT NAME	: 2004 Logan Environmental Status and Planning Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: June 7, 2006

As Secretary of Environmental Affairs, I hereby determine that the Environmental Status and Planning Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00).

The environmental review process at Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become (consistent with the objectives of the MEPA regulations) part of Massachusetts Port Authority's (Massport) long range planning. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific EIRs. The ESPR is currently updated on a five-year basis, with much less detailed Environmental Data Reports filed in the years between submission of the ESPRs. The 2004 ESPR is the subject of this Certificate.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs (EOEA) issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions

where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

This 2004 ESPR was originally scheduled to be completed in 2005, but was postponed until 2006. The 2004 ESPR was delayed because of delays associated with the completion of the New England Regional Aviation System Plan (NERASP). Massport adopted the NERASP forecasts for its 2020 Logan Airport forecast of aviation activity in this ESPR, and upon which the analysis of 2020 environmental conditions is based. Postponing completion of the 2004 ESPR ensured that the forecasts used in the ESPR are the most current and accurate forecasts available.

Review of the 2004 ESPR

In general, the ESPR has responded to the scope. In particular, the ESPR contains a wealth of useful data on activity levels and impacts, and lays out a forecast for trends in the future years. The technical studies in the 2004 ESPR included reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking.

As always, EOEA remains committed to evaluating and addressing the cumulative impacts of airport operations on the nearby communities. In June 2001, Massport agreed to work with EOEA on structuring a proposed Air Quality Initiative (AQI). The Certificate indicated that Massport was "to solicit project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." This Certificate on the ESPR reiterates that Massport has committed to the Air Quality Initiative, a key program designed to mitigate the cumulative air quality impacts of airport operations. The 2005 EDR should detail how Massport is meeting this commitment. The 2005 EDR must also address all of the air quality issues raised by the commenters.

Although Massport has presented a detailed ESPR, I remain concerned with a number of environmental issues, specifically air quality and noise related issues, as outlined below.

Follow-up

Massport should submit the next EDR (analyzing conditions for the 2005 calendar year no later than December 15, 2006. I recognize that this Certificate requires the inclusion of considerable follow-up in that document. However, ESPRs invariably raise important issues which require follow-up sooner rather than later, and this ESPR is no exception. I anticipate that the EDR in a year following the publication of an ESPR will always have to include such analytical follow-up to the ESPR and respond to comments on the ESPR. Other EDRs should provide more of a

"snapshot" of the previous year's operations and impacts, with more substantial analysis awaiting the next GEIR. EDRs in years other than the year immediately following publication of an ESPR should therefore be considerably less voluminous and Massport should strive to submit these documents by July 31 of the year following the subject year.

Responses to Comments

The next EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this ESPR is well-constructed and cross-referenced (although several comments have complained of general responses or document references in response to specific questions). Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2005 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts.

Airport Activity Levels

The ESPR included a chapter on airport activity levels, including information on aircraft operations, fleet mix, passenger activity levels, and cargo and mail operations. This chapter also reported on Massport's forecasts that will become the basis for Massport's strategic planning initiatives over the next few years. Past forecasts were based on low, medium, and high passenger activity levels. New forecasts are now based on the forecasts for 2020 developed for the New England Regional Airport System Plan (NERASP) study. This chapter included aircraft operations and passenger activity forecasts, and provided a discussion of methodologies and assumptions, including anticipated fleet mix changes and other trends in the aviation industry.

Air passenger traffic at Logan Airport continued to rebound in 2004, but remained below the peak year level reached in 2000. The total number of passengers using Logan Airport in 2004 increased by 14.7 percent over 2003 levels to 26.1 million passengers. Although the recovery in passenger demand was underway in 2004 at Logan Airport and throughout the industry, legacy commercial airlines continued to struggle financially as competition from low cost carrier (LCC) rivals increased and fuel prices remained high.

For the first time since 1998, total annual aircraft operations (arrivals and departures) at Logan Airport increased compared to the previous year and were at their highest level since 2001. Daily operations in 2004 averaged approximately 1,107 compared to approximately 1,027 in 2003, an increase of about 80 operations per day or about 8.6 percent. 2004 levels remain below historic peaks. The growth in aircraft activity was driven primarily by the entry and expansion of LCCs at Logan Airport in 2004. This increase in LCC services in 2004 stimulated growth in airport

passenger demand.

In 2004, Logan Airport ranked 19th among US airports in total cargo volume. All-cargo operations at Logan Airport declined by less than 1 percent in 2004. However, total cargo volume, including cargo carried in the belly compartments of passenger aircraft, rose by 0.6 percent.

Airport Planning

This section described the status of planning initiatives and projects through the planning horizon year (2020) for the Terminal Area; Airside Area; Service and Cargo Areas; and Edge Buffers and Landscaping. The Airport Planning Chapter also reported on the status of public works projects implemented by other agencies within the boundaries of Logan Airport.

Several projects were completed in 2004:

- The majority of construction of the main terminal and satellite concourse of Delta Air Lines' Replacement Terminal A Project was completed in 2004.
- A dedicated hourly parking area opened on the lower level of the Terminal B Garage in July 2004.
- Massport also launched Exit Express, Massport's convenient way to pay for parking.
- The Massachusetts Bay Transportation Authority's (MBTA's) $23 million new Blue Line Airport Station opened in June 2004.
- Demolition of the old MBTA Airport Station was completed in 2004.
- By the end of 2004, completion of the Central Artery/Tunnel (CA/T) Project and improvements to the roadway system were complete, allowing for a more efficient roadway network with shorter and more direct routes between destinations in the airport and the regional highway system.
- The Silver Line, the most recent addition to the transit system and Boston's first Bus Rapid Transit line, began limited service to Logan Airport in December 2004.

Both Massport and Logan Airport's tenants are proposing projects or exploring planning options to modernize and carry out future improvements at Logan Airport. Massport's planning criteria for Logan Modernization are based on accommodating 45 million annual passengers in airport terminals, facilities, and on airport roadways. Future projects and planning concepts include:

- Both Massport and Logan Airport's tenants are proposing projects or exploring planning options to modernize and carry out future improvements to the existing terminal facilities. Some projects and planning concepts include ongoing expansion and upgrade of Terminal E and constructing a new satellite Federal Inspectional Services (FIS) Facility at the southeast end of Terminal B.
- Some projects and planning concepts that are underway or under consideration include, consolidating flight kitchen facilities in the north service area, constructing new multi tenant maintenance facilities for ground service equipment (GSE), and constructing new

hangar facilities in the north cargo area.

- Airside improvements include upgrades and improvements to the airfield to enhance the operations efficiency and safety of Logan Airport. Some projects and planning concepts that are underway or under consideration include, installing a security wall along the perimeter of the air operations area, providing additional aircraft parking for certain types of aircraft, and an airside improvements planning project to reduce current and projected levels of aircraft delay.
- Buffer areas are being designed in consultation with Logan Airport's neighbors and other interested parties in an open community planning process. Some future airport buffer projects and planning concepts include, landscaping the former Navy Fuel Pier at Jefferies Point, installing a landscaped border in conjunction with the north service area Economy Parking Lot construction, and constructing a half-acre linear area with landscaping and lighting improvements along Maverick Street.
- Massport is considering a parking strategy to address future on-airport parking demands. Some ongoing and future parking projects and planning concepts include redeveloping three parcels into a combined economy parking facility with the capacity for up to 1,750 vehicles, proposed parking facility in the Southwest Service Area, and a new consolidated facility for all car rental operations

Regional Transportation Context

Overall, aviation activity levels at New England's regional airports increased in 2004, as passenger demand continued to rebound both within the region and nationally after the 2001 downturn. Just as the passenger decline seen at the regional airports in the wake of September 11, 2001 was less severe than the declines experienced at Logan Airport, the traffic recovery seen at the regional airports in 2004 was not as strong as the rebound experienced at Logan Airport. Growth at Logan Airport was largely fueled by a growing presence of LCC services. At the same time, regional airports continued to experience growth in 2004 and served a significant (42.5 percent) share of the region's air passenger traffic. Several factors have contributed to the success of the regional airports in recent years:

- Many of the regional airports benefited from the introduction and growth of LCC services over the past several years. This trend began when Southwest Airlines entered the New England market in 1996 by serving T.F. Green Airport in Warwick, Rhode Island and later expanding into the Manchester and Hartford/Bradley International Airports. The trend continued in 2004 when Spirit Airlines began service from T.F. Green Airport, Independence Air5 initiated low-fare service at several of the regional airports, and Southwest Airlines continued to increase service from its New England airports.
- Several of the smaller airports, particularly Burlington, Bangor, and Tweed-New Haven continued to benefit from the introduction of regional jets and gained new non-stop services to airline connecting hubs, which increase service options for regional airport passengers.

Ground Transportation

The chapter reported on 2004 conditions and provided a comparison of 2004 findings to previous years for variety of ground transportation indicators. The chapter also presented a discussion of analysis methodologies and assumptions for future year conditions for the planning horizon year 2020 for Traffic volumes, On-airport Vehicle miles traveled (VMT) and Parking demand.

- Completion of the CA/T and Logan Airport Modernization projects created a more efficient roadway network with shorter and more direct routes to destinations within Logan Airport.
- With the exception of water transportation, all scheduled and unscheduled high occupancy vehicle (HOV) transportation to Logan Airport saw increased ridership in 2004.
- Overall HOV mode share for air passengers increased from 25.8 percent in 1990 to 32 percent in 2003. Although the data shows a slight decrease to 30.3 percent in HOV modes in 2004, the 2003 HOV mode share was an all-time high, reflecting Massport's success in generally maintaining or increasing the percentage of passengers using HOV modes in all market segments.
- The most recent employee survey showed an employee HOV mode share of 26.8 percent.
- Airport-related average annual daily traffic (ADDT) volumes increased by 12.6 percent in 2004 over 2003 volumes. Despite this increase in ADDT volumes, the vehicle miles traveled (VMT) on Logan Airport's roadway system only increased by 3.5 percent in 2004 compared with the 2003 VMT. This reflects the effects of the changes in the airport roadway system resulting from the CA/T and Logan Airport Modernization projects, which result in a shorter average trip length, creating a much smaller increase in total VMT than in average weekday daily traffic volumes.
- Massport executed a Memorandum of Understanding with the MBTA to commence Silver Line bus rapid transit service in late 2004. Massport's support of the Silver Line Airport service will total more than $30 million over ten years.

Between 2003 and 2004, membership in the Transportation Management Association (TMA) declined by 800 employees, a 13.3% reduction. Massport stated in the ESPR that significant TMA funds had been expended for administrative functions resulting in underfunded programming. The Executive Office of Transportation's MassRIDES program will now provide a TMA coordinator at state expense. The EOT identified its expectation that Massport will "maintain its current level of effort, including both cash contributions and in-kind services.

The Secretary's June 15, 2001 Certificate on the AIPP directs Massport to require that all Logan employers join the TMA at the earliest possible opportunity. This mitigation measure is not listed in Table 10-7 and no plan is presented for meeting this requirement. A plan should be detailed in the 2005 EDR.

The ESPR indicated that two FAA programs had relocated to New Hampshire in 2004 and that Beacon-Skanska, having completed the construction of Terminal A, was no longer at Logan. Four additional corporate members left the TMA in 2004. The 2005 EDR should provide explanation for this.

The 2003 EDR stated that TMA shuttle ridership declined by 32.4 percent due to the elimination of services at mid-year due to lack of funding., but that the decrease in shuttle ridership had been more than off-set by increased Logan Express use. Massport should identify any efforts such as more active marketing of car/ridesharing options targeted to those who previously used the cancelled shuttles. This information should be provided in the 2005 EDR.

Noise

This chapter began with an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, the methodologies used to track noise, and what if any changes there was in noise modeling. The information in this chapter built upon the findings of the Boston Logan Overflight Noise Study. This chapter also updates the status Massport's efforts to reduce noise levels and provides noise contours population counts for 2020.

- Massport has continued to make improvements in the noise modeling process as the sophistication of noise models and data acquisition systems has advanced. Recent developments in noise modeling technologies and techniques employed in this 2004 ESPR and to be used in future years include: use of a new radar data acquisition system, known as a long-range PASSUR, for the source of all radar-based operations data; a new upgrade to Massport's radar data processing software; use of the latest update to the FAA's Integrated Noise Model, while retaining the unique capability to account for over-water sound propagation and hill effects unique to Logan Airport; incorporation of more than 1,800 modeled flight tracks, checked and updated where necessary to reflect 2004 radar data; use of radar data to determine the "best-fit" match among each of the nearly 402,000 radar traces captured by Logan Airport's noise monitoring system and the available climb profile contained within the INM database; procurement of an improved noise and operations monitoring system; procurement of automated altitude profile and noise contour generation software.
- From May to August 2004, Runway 4L-22R was closed either completely or partially to accommodate repaving. Due to this closure, jet aircraft departures on Runway 22R decreased by approximately 23 percent compared to 20036 while departures on other runways increased.
- As a result of changes in airport operations in 2004, the number of people exposed to Day-Night Sound Level (DNL) values greater than 65 dB increased compared to the number in 2003. An estimated 10,720 people were exposed to DNL levels greater than 65 dB in 2004, compared to 7,183 in 2003, and 8,309 in 2002. The majority of the increase occurred in East Boston off the northwest end of Runway 33L. The increases within the

65dB are in areas that were previously sound insulated. Despite these increases, the total count of people exposed to 65 dB DNL and above was 23 percent lower than in 2001.

- The 2004 Cumulative Noise Index (CNI) of 153.4 Effective Perceived Noise Level (EPNdB) remained well below the cap of 156.5 EPNdB. Although CNI also increased compared to 2003 and 2002 as a result of the increased number of operations, the 2004 level remained below the 2001 CNI value.

- The number of residential dwelling units for which Massport provided sound insulation in 2004 was 791. Since the program's inception, the total number of dwelling units receiving sound insulation is now 8,615. In addition, Massport completed sound insulation of a 36th school – the new Center School located in Winthrop.

The Logan Airport Noise Study is now expected to be conducted in at least three phases. I strongly encourage Massport to include a phase for the monitoring and assessment of altered flight paths so that any necessary modifications can be identified and implemented.

In addition, the ESPR indicated that there will be an increase from 2004 to 2020 in the number of Boston residents who will experience noise in the 70-75 DNL and the 75-80 DNL due to the use of parallel runways. Massport strive to identify ways to ensure that these increases do not occur. The 2005 EDR should include a preliminary discussion about how Massport will address projected exceedances.

Air Quality

This chapter presented an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. It also predicts emission levels for 2020.

- To ensure consistency and comparability between 1999 and 2004 air quality emissions, the 1999 air emissions inventory was updated with information that was not available when first reported and 1999 emissions were recalculated using the new version of the FAA's Emissions and Dispersion Modeling System (EDMS) v4.21. Additional data were also added to the 2004 inventory in order to increase the accuracy of the results, for example curbside queue times were updated and new parking areas were added to the inventory.

- In 2004, the emission inventory results were driven by an 8 percent increase in aircraft operations compared to 2003 activity levels. Increases in stationary source (fuel storage facilities, heating plant, etc.) emissions further contributed to the increase in levels of volatile organic compounds (VOCs) and oxides of nitrogen (NOx).
- In 2004, total VOC emissions at Logan Airport were estimated to be approximately 1,360

kilograms (kg)/day, which is an increase of 17 percent from 2003 levels. However, total VOC emissions at Logan Airport were 41 percent lower in 2004 than in 1999. The increase of VOC emissions between 2003 and 2004 was due to the increase in aircraft operations in 2004.

- In 2004, total NOx emissions from all airport-related sources were estimated to be 4,290 kg/day, which is an increase of 16 percent from 2003 levels, but is a 26 percent decrease as compared to 1999 levels. Once again, the increase in aircraft operations contributed the most to this increase in airport-related NOx in 2004.

- Total carbon monoxide (CO) emissions at Logan Airport in 2004 were estimated to be 9,852 kg/day, or 3 percent below 2003 levels. In 2004, total CO emissions at Logan Airport were 32 percent lower than 1999 levels. While CO emissions from aircraft increased due to increased aircraft operations, the use of alternative fuel vehicles (AFVs) and the lower emission rates of the motor vehicle fleet helped to reduce the overall CO emissions in 2004. Massport added three new AFVs to its fleet in 2004.

- Massport developed an Air Quality Initiative (AQI) in 2001 as a long-range program with the overall goal to maintain NOx emissions associated with Logan Airport at or below the 1999 level of 2,347 tpy. In 2004, NOx emissions from all airport-related sources were estimated to be 1,726 tpy, well below the 1999 level.

Through the June 15, 2001 Certificate of the Secretary of EOEA on the FEIR for the AIPP, Massport was directed to develop a program to maximize the use of single-engine taxiing procedures by all of its tenant airlines. Massport must describe in the 2005 EDR how it presently encourages reduced-engine (single-engine) taxiing. The cited issues of safety and practicality should be discussed and the program that will be implemented as noted in Table 10-7of the 2005 ESPR should be outlined.

Massport was also directed in the same Certificate to conduct follow-up air quality monitoring in neighborhoods surrounding the airport and surrounding flight paths. This mitigation measure does not appear in Table 10-7, "Logan Airside Improvements Planning Project, Details of Ongoing Section 61 Mitigation Measures." The 2005 EDR should address this measure in detail.

Table 7-13 of the 2004 ESPR , "Inventory of Tracking of NOx Emissions in tons per year for Logan Airport," contains numbers that have been "adjusted to reflect know reductions achieved by Massport and its tenants at Logan Airport." The 2005 EDR should include unadjusted numbers and detailed information about the means for achieving reductions and the emissions value of each reduction method.

Massport had agreed to work with EOEA on structuring a proposed Air Quality Initiative (AQI) in the June 2001 Certificate for the AIPP. The Certificate indicated that Massport was "to solicit

project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." There is no information in the ESPR about the substance and status of any process with EOEA or about the solicitation of information and objective, neutral, scientific review. The 2005 EDR should address this matter in detail.

Environmental Management/Water Quality/Environmental Compliance

This chapter reported on the activities of Massport's Environmental Management Unit in meeting the state's environmental regulatory requirements.

- In 2004, of the 126 spills reported to the Logan Airport Fire-Rescue Department, 18 spills (14 percent) were ten gallons or greater in quantity. Jet fuel spills accounted for 82 (65 percent) of the total spills, with 12 spills (15 percent) being ten gallons or greater in quantity. The remaining 44 spills involved gasoline, hydraulic oil, diesel fuel, ethylene glycol, propylene glycol, paint, and AVGAS. Of these spills, 6 (14 percent) were ten gallons or greater. Since 2002 there has been a reduction in the total volume of all spills.

- In accordance with the Massachusetts Contingency Plan (MCP), Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Massport indicates that it has had limited success in identifying the causes of exceedances due to "first flush" pollutants in stormwater, the number of potential sources at Logan, and the size of drainage areas serving outfalls. Massport needs to develop a plan for maximizing its ability to identify causes. This plan should be identified in the 2005 EDR. Massport should also include in the 2005 EDR copies of any new NPDES stormwater and fire training permits.

Sustainability Initiatives

This Chapter presented Massport's on-going and upcoming sustainability initiatives at Logan Airport. Massport continues to demonstrate forward thinking in sustainability policies and practices for transportation agencies. I encourage Massport to require tenant participation and compliance with all elements of the plan as leases are renewed.

As I stated at the beginning of this Certificate, the 2005 EDR must provide responses to the issues raised in comments received. The 2005 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2004 ESPR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, and noise abatement. Massport should consult directly with individual commentors where necessary.

A distribution list for the 2005 EDR (indicating those receiving documents, CDs, or Notices of

Availability) should be provided in the document. This section must also include copies of all GEIR/Annual Update Certificates issued since 1995 to provide context for reviewers. Supporting technical appendices should be provided as necessary.

August 16, 2006
Date

Robert W. Golledge, Jr.

Comments received:

07/25/06	Stephen Kaiser
08/08/06	Nancy Timmerman
08/09/06	MA Executive Office of Health and Human Services
08/09/06	John Vitagliano
08/09/06	Bruce Egan, Egan Environmental
08/10/06	City of Boston Environment Department
08/14/06	Boston Transportation Department

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February 15, 2007

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
2005 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2005 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: December 23, 2006

As Secretary of Environmental Affairs, I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00).

The environmental review process at Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become (consistent with the objectives of the MEPA regulations) part of Massachusetts Port Authority's (Massport) long range planning. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific EIRs. The ESPR is currently updated on a five-year basis, with much less detailed Environmental Data Reports (EDR) filed in the years between submission of the ESPRs. The 2005 EDR is the subject of this Certificate.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs (EOEA) issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

Review of the 2005 EDR

In general, the EDR has fulfilled its purpose of providing a "snapshot" of year 2005 passenger and impact levels at Logan Airport. Most environmental parameters showed significant improvement in calendar year 2005. In particular, the technical studies in the 2005 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking.

As always, EOEA remains committed to evaluating and addressing the cumulative impacts of airport operations on the nearby communities. In June 2001, Massport agreed to work with EOEA on structuring a proposed Air Quality Initiative (AQI). The Certificate indicated that Massport was "to solicit project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." The 2005 EDR reiterates that Massport has committed to the Air Quality Initiative, a key program designed to mitigate the cumulative air quality impacts of airport operations. The 2005 EDR details how Massport is meeting this commitment. The 2006 EDR should continue to report on the details of Massport's committment. In addition to the environmental issues listed below, the 2006 EDR should address all of the air quality and noise related issues raised by the commenters during the review of the 2005 EDR.

Follow-up

Massport should file the next EDR (covering operations for the 2006 calendar year) in calendar year 2007. The EDR should provide more of a "snapshot" of the 2006 operations and impacts, with more substantial analysis awaiting the next GEIR. Massport should also address the comments received on the current EDR when developing its 2006 EDR.

Responses to Comments

The next EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments

included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2005 EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2006 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts.

Activity Levels

The Activity Levels chapter presents aviation activity statistics for Logan Airport in 2005 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. Air passenger traffic at Logan Airport continued to rebound in 2005, but remained below the peak year level reached in 2000. Specifically, the total number of passengers using Logan Airport in 2005 increased by 3.6 percent over the prior year to 27.1 million passengers. In 2005, total aircraft operations (409,066 operations) at Logan Airport increased by 0.9 percent over 2004 levels. While 2005 passenger traffic at Logan Airport was approximately equal to 1999 levels, in 2005 these passengers were being carried on approximately 86,000 fewer flights (495,000 flights in 1999 versus 409,066 flights in 2005). Several commenters raised concerns with the increase in passenger levels requesting long-term solutions to meeting demand which do not include expansion of Logan Airport's capacity or footprint. I advise Massport to consider and attempt to address these comments in the next 20006 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2005. It also describes known future planning, construction, and permitting activities. Specifically, several projects were completed in 2005 including the majority of construction of the main terminal and satellite concourse of Delta Air Lines' Replacement. Terminal A Project was completed in 2004, with final fit up and commissioning in 2005. Massport also launched Exit Express as part of an on-going program to improve parking facilities and improve air quality through enhanced circulation and reduced idling at the toll booths. In addition, as part of a cooperative venture between the Massachusetts Bay Transportation Authority (MBTA) and Massport, initial Silver Line service to the airport began in December 2004. Full Silver Line service to Logan Airport began on June 1, 2005.

The chapter also includes future planning including: ongoing expansion and upgrade of Terminal E and completion of West Garage Phase II(Central Garage Expansion); more efficient ways of using the limited land resources in the service areas; airside improvements include upgrades and improvements to the airfield to enhance the operations, efficiency and safety of Logan Airport; In addition, buffer areas are being designed in consultation with Logan Airport's neighbors and other interested parties in a community planning process. Massport is also considering a parking strategy to address future on-airport parking demands. Some ongoing and future parking projects and planning concepts include redeveloping three parcels into a combined economy parking

facility with the capacity for up to 1,750 vehicles and a new consolidated facility for all car rental operations.

Regional Transportation

This chapter describes activity levels at New England's regional airports in 2005 and updates recent planning activities. Overall, the number of air passengers utilizing New England's primary commercial service airports in 2005 rose by 5.3 percent over 2004. When measured by aircraft operations, however, activity levels fell by 0.6 percent. This reflects sweeping changes in both the commercial aviation and general aviation (GA) sectors of the industry. Passenger numbers rose despite capacity reductions as airlines operated at higher load factors. Carriers flew fewer flights to the regional airports than in 2004, but used larger aircraft on average in 2005, and carried more passengers. GA operations at New England airports declined by 3.8 percent from the 2004 levels. The Boston Transportation Department has raised a number of suggestions related to the Regional Transportation that Massport should consider in the 2006 EDR.

Ground Transportation

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2005. Specifically, ground transportation activity levels increased from 2004 to 2005 as a result of a 3.6 percent increase in the number of air passengers. In addition, traffic volumes on airport roadways increased by 5.8 percent, while the vehicle miles traveled (VMT) on the airport increased by 4.2 percent. The lower VMT growth when compared to overall traffic volume growth suggests that more direct connections over shorter roadway distances are provided. The facilities at the MBTA Blue Line Airport Station were also substantially improved in 2005, including the conversion from a manual to an automated fare collection system. In addition, full MBTA Silver Line service to Logan Airport began on June 1, 2005. In 2005, Terminal A and its associated access roadways were fully opened for operation. There were no other roadway modifications completed in 2005. In addition, contract negotiations began between Massport and the C & J Bus Company in New Hampshire to expand early morning transportation between New Hampshire and Logan Airport. This service began in 2006. Massport also re-bid its Logan Airport Transportation Management Association (Logan TMA) contract with the Executive Office of Transportation (EOT) through the MassRIDES program.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2005, and describes Massport's efforts to reduce noise levels. In 2005, the number of people exposed to Day-Night Sound Level (DNL) values greater than 65 decibels (dB) decreased compared to 2004. An estimated 6,477 people were exposed to DNL levels greater than 65 dB in 2005, compared to 9,438 in 2004, and 7,183 in 2003. The total count of people exposed to 65 dB Day-Night Sound Level (DNL) and above was 55 percent lower than in 2001. Winthrop, which has always experienced the highest levels of noise exposure of any community around Logan Airport, continued its decline in the number of people exposed to levels greater than 65 DNL. This number has dropped 81 percent since reaching its peak in 1998. The number of residents

exposed to noise over 75 DNL increased from 2004 but still remained below 2001 levels.

The 2005 Cumulative Noise Index (CNI) of 153.2 Effective Perceived Noise Level (EPNdB) remained well below the cap of 156.5 EPNdB. The CNI decreased slightly compared to 2004 even with a slight increase in the number of operations in 2005. This decrease is primarily due to decreased use of recertified aircraft by cargo operators. Massport provided sound insulation for 471 residential dwelling units in 2005. Since the program's inception, Massport has sound insulated a total of 9,086 dwelling units. The majority of the units insulated in 2005 were in Winthrop.

The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2006 EDR. I also strongly advise Massport to consider and address the numerous comments received that have raised noise related concerns in comments.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2005 and efforts to reduce emissions. The 2005 emissions inventory results are driven by the small increase in aircraft operations at Logan Airport compared to 2004 levels. Compared to 2004 levels, total emissions of volatile organic compounds (VOCs) are estimated to have decreased by approximately 6 percent to 1,285 kilograms per day (kg/day). In 2005, total emissions of oxides of nitrogen (NOx) were estimated to be 4,187 kg/day, which is a 2 percent decrease from 2004 levels. Total emissions of carbon monoxide (CO) in 2005 were 9,556 kg/day, or 3 percent lower than 2004 levels.

For the first time, estimates of particulate matter emissions associated with Logan Airport are reported in this 2005 EDR in response to the recent availability of an FAA-approved method for computing particulate matter emission factors for aircraft. Total emissions of particulate matter (PM2.5) at Logan Airport in 2005 were approximately 83 kg/day [33 tons/year (tpy)]. NOx emissions at Logan Airport in 2005 were approximately 662 tpy lower than 1999 levels—a 28 percent decrease. It appears that there is an ongoing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the general vicinity of Logan Airport. In addition, annual NO2 concentrations at all monitoring locations were well below the NO2 air quality standards in 2005. The 2006 EDR should continue updates on the information presented in the 2005 EDR.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management. Specifically, of the 97 spills reported in 2005, 15 (15 percent) were ten gallons or greater in quantity. Jet fuel spills accounted for 66 (68 percent) of the total spills, 12 of the jet fuel spills (18 percent) were ten gallons or greater in quantity. The remaining 31 spills involved gasoline, hydraulic oil, diesel fuel, and other substances. Of these spills, only

three (10 percent) were ten gallons or greater. In 2005, only eight samples exceeded the regulatory limits. The North Outfall had two samples which exceeded the 15 milligrams per liter (mg/L) National Pollutant Discharge Elimination System (NPDES) limit for oil and grease, and the Porter Street Outfall had one sample exceed this limit. The North Outfall had two samples which exceeded the 0.3 milliliters per liter (ml/L) daily maximum limit for settable solids, and the West Outfall had three samples exceed this limit. No other exceedances occurred. In accordance with the Massachusetts Contingency Plan (MCP), Massport should continue to report in the 2006 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Sustainability at Logan Airport

This chapter describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision. This chapter describes Massport's continued efforts.

As I stated at the beginning of this Certificate, the 2006 EDR must provide responses to the issues raised in comments received. The 2006 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2005 EDR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, and noise abatement. Massport should consult directly with individual commentors where necessary.

A distribution list for the 2006 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all GEIR/Annual Update Certificates issued since 1995 to provide context for reviewers. Supporting technical appendices should be provided as necessary.

February 15, 2007
Date

Ian A. Bowles

Comments Received:

01/30/07	State Representative Robert A. DeLeo
01/31/07	Joseph Felzani
02/05/07	Boston Transportation Department
02/06/07	Nancy Timmerman
02/07/07	Stephen Kaiser
02/13/07	City of Boston Environment Department

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November 1, 2007

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
2006 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2006 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: September 25, 2007

As Secretary of Executive Office of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00).

The environmental review process at Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long range plans. It has thus become (consistent with the objectives of the MEPA regulations) part of Massport's long range planning. In recognition of the increased role of planning in the GEIR process, the name of the document was changed to ESPR. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific EIRs. The ESPR is currently updated on a 5-year basis, with much less detailed Environmental Data

Reports (formerly Annual Updates) filed in the years between ESPRs. The 2006 EDR is the subject of this Certificate.

In general, the EDR has fulfilled its purpose of providing a "snapshot" of year 2006 passenger and impact levels at Logan Airport. Most environmental parameters showed improvement in calendar year 2006. In particular, the technical studies in the 2006 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Mitigation of noise impacts and air quality remain key concerns both of this office and the commenters. These commitments take the form of project-specific Section 61 Findings, as well as more general mitigation that has emerged from the ESPR process.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

Review of the 2006 EDR

As always, EEA remains committed to evaluating and addressing the cumulative impacts of airport operations on the nearby communities. In June 2001, Massport agreed to work with EEA on structuring a proposed Air Quality Initiative (AQI). The Certificate indicated that Massport was "to solicit project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." The 2006 EDR reiterates that Massport has committed to the Air Quality Initiative, a key program designed to mitigate the cumulative air quality impacts of airport operations. The 2006 EDR details how Massport is meeting this commitment. The 2007 EDR should continue to report on the details of Massport's commitment and address the concerns raised by the City of Boston's Environment Department on this issue. In addition to the environmental issues listed below, the 2007 EDR should address all of the air quality and noise related issues raised by the commenters during the review of the 2006 EDR.

Procedural

Given the overall strength of the analysis in the 2006 EDR, the 2007 EDR can restrict itself to providing an update on 2007 conditions, and respond to those issues explicitly noted in this

Certificate and the comments received as requiring response in the next EDR. The EDR should provide a "snapshot" of the 2007 operations and impacts, with more substantial analysis awaiting the next ESPR. Massport should file the 2007 EDR no later than October 15, 2008 (although I encourage Massport to file sooner, given the relatively few requirements for the next EDR).

A distribution list for the 2007 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan Environmental Status and Planning Report (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary.

Responses to Comments

The comments received on the 2006 EDR are thoughtful and detailed although I note that some of the comments were received only one day before this Certificate was to be issued. I request that during the review of the 2007 EDR that commenters make every attempt to submit comments by the close of the comment period to allow time for review. The 2007 EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2006 EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2007 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commentors where necessary.

Organization of the Certificate

I have organized the remainder of this Certificate to respond to issues raised roughly in the order in which they were presented in the 2006 EDR, although I have for the most part incorporated discussion of issues raised in the technical appendix into the discussion of the environmental impact analyses.

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2006 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. Air passenger traffic at Logan Airport reached 27.7 million, up from 27.1 million in 2005. The total number of aircraft

operations decreased in 2006 even though the total number of air passengers increased because airlines increased the number of passengers per aircraft operation. Specifically, the total number of aircraft operations declined from 409,066 in 2005 to 406,119 in 2006 which is a decrease of 0.7 percent. Air cargo volumes continued to decline from 728 million pounds in 2005 to 679 million pounds in 2006 with the largest volume decrease in the express/small packages. I advise Massport to consider and attempt to address all comments related to activity levels in the next 2007 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2006. It also describes known future planning, construction, and permitting activities. Specifically, several projects were completed in 2006. The new Terminal A, which opened on March 16, 2005, achieved Leadership in Energy and Environmental Design (LEED) certification in June 2006. It is the first airport terminal in the U.S. to earn this ranking. In addition, in November, 2006 the MBTA Silver Line service was enhanced with the addition of the Massachusetts Bay Transportation Authority's (MBTA) Charlie Card automatic fare collection kiosks in all Logan Airport terminals. Several construction projects were also completed, including the construction of the North Service Road (SR-2) Roadway Buffer, which consists of a sidewalk linking the Blue Line Airport Station to Logan Airport Terminals, and a landscaped area adjacent to the sidewalk. Construction of Phase 1 of the Southwest Service Area (SWSA) buffer, which began in 2005, was completed in the fall of 2006, and the Navy Fuel Pier Edge Buffer was completed in December 2006.

Regional Transportation

This chapter describes activity levels at New England's regional airports in 2006 and updates recent planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2006 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions.

In general, the 2006 EDR has met the requirements laid out in the ESPR Certificate. The directives in the ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2006 EDR has performed this task.

Overall, the number of air passengers utilizing New England's primary commercial service airports in 2006 declined marginally, from 48.0 million to 47.9 million. When measured by the number of aircraft operations, however, activity levels fell by 4.4 percent, from 1.4 million operations to 1.3 million operations. This reflects substantial changes in the commercial aviation sector and the continued decline of general aviation (GA) noted in the 2005 EDR. Major airlines

reduced capacity at the regional airports in 2006 as they reconfigured their operations in an effort to consolidate gains made in bankruptcy and near-bankruptcy restructuring. Passenger declines were generally consistent with capacity reductions. In addition, the average aircraft size of scheduled flights to the regional airports declined in 2006 as airlines substituted regional jet service for mainline jets on certain routes. Declines in GA activity in New England (declined by 4.2 percent from 2005 levels) continue to outpace declines in the rest of the country. According to the FAA as reported in the 2006 EDR, GA activity declined by 1.3 percent nationally in 2006, largely due to rising fuel costs.

Ground Transportation

The 2006 EDR serves its purpose of updating 2006 ground access conditions on the airport, and has also adequately addressed the larger ground access issues identified in previous Certificates, as discussed below.

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2006. Specifically, ground transportation activity levels increased across the board from 2005 to 2006 as a result of a 2.4 percent increase in the number of air passengers. Also, a portion of I-90 connecting the City of Boston and areas to the south and west of Boston to Logan Airport was closed from July 2006 until early 2007, which is believed to have reduced traffic flows to and from the Airport. The 2006 EDR reports that ridership on the MBTA, Logan Express, water transportation, scheduled and unscheduled HOV Services, and taxis increased in 2006. This is due in part to the completion of roadway and other construction projects at the Airport, and to the closure of the I-90 connector to the Airport for much of 2006. Massport-subsidized service provided by the C & J Bus Company began in 2006 providing early morning transportation between New Hampshire and Logan Airport. The 2006 EDR also reports that the number of on-Airport parkers decreased by 8.4 percent in 2006.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2006, and describes Massport's efforts to reduce noise levels. The technical appendix contains useful and detailed information, while the main text provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring a point raised by several commenters. The EDR represents an appropriate forum to serve this updating function.

In 2006, the overall number of people exposed to Day-Night Sound Level (DNL) values greater than 65 decibels (dB) decreased in 2006 compared to 2005. An estimated 5,583 people were exposed to DNL levels greater than 65 dB in 2006, compared to 6,477 in 2005, and 9,438 in 2004. For the second year in a row, fewer than 7,000 people experienced levels of 65 dB DNL and above. The 2006 Cumulative Noise Index (CNI) of 152.6 Effective Perceived Noise Level (EPNdB) remained well below the cap of 156.5 EPNdB. The CNI decreased compared to 2005

primarily because of decreased use of recertificated aircraft by cargo operators.

Massport provided sound insulation for 857 residential dwelling units in 2006. This is the largest number of units to receive sound insulation in the vicinity of the Airport in any one year since the beginning of the program. Since the program's inception, Massport has sound insulated a total of 9,943 dwelling units. The majority of the units insulated in 2006 were in Chelsea.

The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2007 EDR. I also strongly advise Massport to consider and address the comments received that have raised noise related concerns.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2006 and efforts to reduce emissions.

The emissions inventory results are driven largely by improvements to the FAA Emissions and Dispersion Modeling System (EDMS), v5.0.1. These include the addition of aircraft main engine startup VOC emissions; adjustments to how aircraft performance profiles are modeled, which changed aircraft times-in-mode and thus emissions of all pollutants; an advanced method to calculate aircraft PM10/PM2.5 emissions; and updated ground support equipment (GSE) emission factors using NONROAD2005. The in-place air quality initiatives at Logan Airport and other ongoing efforts by Massport to minimize emissions also played a role, as did changes to aircraft taxi time, fleet mix, and number of operations.

The 2006 EDR reports that emissions inventory changes show an increase in VOC over 2005 levels attributed to the changes to EDMS. The 2006 EDR reported that total VOC emission number is up 34 percent (1,724 kg/day). The total NO_x emissions were one percent lower than reported in the 2005 EDR. In 2006, NOx emissions at Logan Airport were approximately 677 tons per year (tpy) lower than the 1999 threshold level established by Massport's Air Quality Initiative. This represents a 28 percent decrease since1999. There was a continuing trend of decreasing NO2 concentrations at both the Massport and Massachusetts Department of Environmental Protection (MDEP) monitoring sites located in the general vicinity of Logan Airport. In addition, in 2006 the annual NO2 concentrations at all monitoring locations were well below the NO2 air quality standards.

For the second year (2005 EDR was the first year), estimates of particulate matter emissions associated with Logan Airport are reported in this 2006 EDR in response to the recent availability of an FAA-approved method for computing particulate matter emission factors for aircraft. The total CO decreased 15 percent and the total PM_{10} /$PM_{2.5}$ decreased seven percent below the 2005 EDR reported numbers.

The 2006 EDR emissions inventory analysis used the actual aircraft fleet mix, except in the few

instances where aircraft/engine types or combinations were not available in the EDMS database. Data included aircraft type, engine, landing and takeoff operations (LTOs) and aircraft taxi times. Aircraft types are divided into four categories: commercial air carriers, commuter aircraft, general aviation and cargo.

The 2007 EDR should continue updates on the information presented in the 2006 EDR and address comments received related to air quality. In particular the City of Boston has raised several concerns the Massachusetts Department of Public Health's (DPH) Logan Airport Health Study and the air quality monitoring study. The 2007 EDR should update the status of discussions with the City of Boston related to this concern.

Last, I ask that Massport consult with the MEPA office regarding the recently promulgated Greenhouse Gas Emissions Policy and Protocol prior to subsequent filings.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management. Specifically, Logan Airport experienced 92 hazardous material spills in 2006, 11 (12 percent) were considered reportable (i.e., over 10 gallons) under the applicable environmental regulations. Jet fuel spills accounted for 65 (71 percent) of the total spills, with nine of the jet fuel spills exceeding 10 gallons. The remaining 27 spills (29 percent) involved gasoline, hydraulic oil, diesel fuel, and other substances, including two reportable spills.

In 2006, only four of 332 outfall samples exceeded the regulatory limits. The West Outfall and the Maverick Street Outfall each had one sample which exceeded the 15 milligrams per liter (mg/L) National Pollutant Discharge Elimination System (NPDES) limit for oil and grease. The North Outfall had two samples which exceeded the 0.3 milliliters per liter (ml/L) daily maximum limit for settable solids. This is an improvement compared to 2005, when eight samples exceeded the regulatory limits. In accordance with the Massachusetts Contingency Plan (MCP), Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. In 2006, two of its five MCP sites were closed out, and Massport was working towards achieving regulatory closure of the three remaining MCP sites. In accordance with the Massachusetts Contingency Plan (MCP), Massport should continue to report in the 2007 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Sustainability at Logan Airport

This chapter describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable

design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision.

This chapter describes Massport's continued efforts including Massport-wide sustainability and details how sustainability is incorporated into many aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance.

Massport has been a leader in sustainable development. Terminal A, which opened in 2005, received LEED certification in 2006. It is the first airport terminal in the country to receive such certification, and is a model for other airports in the country. In addition, in an effort to reduce air pollutants, Massport is phasing in alternative fuel vehicles in place of conventionally-fuel vehicles. At the airport, Massport maintains electric vehicles infrastructure, as well as a privately operated CNG station to power newer vehicles. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2007 EDR.

November 1, 2007
Date

Ian A. Bowles

Comments Received:

10/24/07	Nancy Timmerman
10/25/07	Stephen Kaiser
10/26/07	**Town of Lincoln**, Lincoln Board of Selectmen
10/31/07	City of Boston's Environment Department
10/31/07	The Boston Harbor Association

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October 31, 2008

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
2007 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2007 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: September 24, 2008

As Secretary of Executive Office of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00).

The environmental review process at Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long range plans. It has thus become (consistent with the objectives of the MEPA regulations) part of Massport's long range planning. In recognition of the increased role of planning in the Generic Environmental Impact Report (GEIR) process, the name of the document was changed to ESPR. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific EIRs. The ESPR is currently updated on a 5-year basis, with much less detailed Environmental Data Reports (EDR) (formerly Annual Updates) filed in the years between ESPRs. The 2007 EDR is the subject of this Certificate.

In general, the EDR has fulfilled its purpose of providing a "snapshot" of year 2007 passenger and impact levels at Logan Airport. Most environmental parameters showed improvement in calendar year 2007. In particular, the technical studies in the 2007 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Mitigation of noise impacts and air quality remain key concerns both of this office and the commenters. These commitments take the form of project-specific Section 61 Findings, as well as more general mitigation that has emerged from the ESPR process.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

Review of the 2007 EDR

As always, EEA remains committed to evaluating and addressing the cumulative impacts of airport operations on the nearby communities. In June 2001, Massport agreed to work with EEA on structuring a proposed Air Quality Initiative (AQI). The Certificate indicated that Massport was "to solicit project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." The 2007 EDR reiterates that Massport has committed to the Air Quality Initiative, a key program designed to mitigate the cumulative air quality impacts of airport operations. The 2007 EDR details how Massport is meeting this commitment. The 2008 EDR should continue to report on the details of Massport's commitment and address the concerns raised by the commenters on this issue. In addition to the environmental issues listed below, the 2008 EDR should address all of the air quality and noise related issues raised by the commenters during the review of the 2007 EDR.

Procedural for 2008 EDR

Given the overall strength of the analysis in the 2007 EDR, the 2008 EDR can restrict itself to providing an update on 2008 conditions, and respond to those issues explicitly noted in this Certificate and the comments received as requiring response in the next EDR. The EDR should

provide a "snapshot" of the 2008 operations and impacts, with more substantial analysis awaiting the next ESPR. Massport should file the 2008 EDR no later than October 15, 2009 (although I encourage Massport to file sooner).

A distribution list for the 2008 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan Environmental Status and Planning Report (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary.

Responses to Comments

The comments received on the 2007 EDR are thoughtful and detailed. The 2008 EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2007 EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2008 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commentors where appropriate.

Organization of the Certificate

I have organized the remainder of this Certificate to respond to issues raised roughly in the order in which they were presented in the 2007 EDR, although I have for the most part incorporated discussion of issues raised in the technical appendix into the discussion of the environmental impact analyses.

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2007 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. In 2007, the total number of air passengers reached 28.1 million, up from 27.7 million in 2006. The increase in the total number of air passengers at Logan Airport was 1.4 percent compared to 2.4 percent in the previous year. Specifically, the total number of aircraft operations declined from 406,119 in 2006 to 399,537 in 2007, a decrease of 1.6 percent. Operations by general aviation (GA) aircraft

decreased most significantly (8.9 percent) in 2007 as compared to passenger and cargo operations. As a result of continued passenger growth and a reduction in operations, the number of air passengers per aircraft operation continued to increase in 2007. Air cargo volumes, continued to decline from 679 million pounds in 2006 to 632 million pounds in 2007. In addition to reporting the analysis of major activity issues, I advise Massport to consider and attempt to address all comments related to activity levels in the 2008 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2007. It also describes known future planning, construction, and permitting activities. Several projects were completed in 2007 including the International Gateway Project (Terminal E) Phase 2. The Federal Inspection Services (FIS) facility was enlarged and the new arrivals level was constructed with the other Phase 2 improvements. The replacement GA Facility in the North Cargo Area was completed and opened in June, 2007 and the southwest corner of Taxiway D was realigned. In addition, the Terminal Area Roadway Landscaping was completed in 2007 and significant portions of Bremen Street Park were completed in early 2007. Also Phase II of the West Garage Project was completed which added three levels of parking to the Central Garage.

Regional Transportation

In general, the 2007 EDR has met the requirements laid out in the ESPR Certificate with respect to regional transportation issues. This chapter describes activity levels at New England's regional airports in 2007 and updates recent planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2007 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions. The total number of air passengers using New England's primary commercial service airports in 2007 increased marginally, from 47.13 million in 2006 to 47.2 million. Of the 47.2 million air passengers using New England's primary commercial service airports in 2007, 60 percent utilized Logan Airport as compared to 88 percent in 1995. When measured by the number of aircraft operations, activity levels fell by 2.1 percent, from 1.33 million operations in 2006 to 1.31 million operations in 2007.

The directives in the ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2007 EDR has performed this task. I direct Massport to continue the directive from the ESPR Certificate for the 2008 EDR.

This chapter also reflects that passenger traffic at the regional airports fell by 1.6 percent. Major airlines reduced capacity at the regional airports in 2007 because they eliminated unprofitable

routes and reduced their domestic flying to deal with the high and rising cost of fuel. Passenger declines were generally consistent with capacity reductions. Declines in GA activity in New England (declined by 3.5 percent compared with 2.6 percent nationally in 2007) continue to outpace declines in the rest of the country, which is largely attributed to the impact of rising fuel costs on recreational flying.

Ground Transportation

The 2007 EDR serves its purpose of updating 2007 ground access conditions on the airport, and has also adequately addresses the updating of the three new programs to support employees' use of alternative transportation options.

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2007. Specifically, ground transportation activity levels increased across the board from 2006 to 2007 as a result of a 1.4 percent increase in the number of air passengers. The re-opening of Interstate 90 (I-90) connecting the City of Boston and areas to the south and west of Boston to Logan Airport resulted in increased traffic flows to and from the Airport when compared to previous years. The 2007 EDR reports that ridership on water transportation, scheduled and unscheduled high occupancy vehicle (HOV) services, and employee ridership on Logan Express increased over 2005 levels. The 2007 EDR also reports that the number of on-Airport parkers decreased by 16.9 percent in 2007 compared to 2005. A portion of this decrease is likely due to the increase of pick-up and drop-off at the Airport.

I also note that this chapter discusses that the Logan Employee Transportation Management Association (Logan TMA) introduced and implemented three new programs to support employees' use of alternative transportation options: the Sunrise Shuttle, which provides shuttle services between 3:00 AM and 5:30 AM for Airport employees who reside in East Boston; the Logan TMA Preferential Carpooling, which provides free terminal garage parking to employees in Logan TMA member companies who carpool in groups of three or more; and the Commuter Cash program, which financially rewards employees ($3/day) who switch from driving alone to either carpooling, bicycling, walking, or using public transportation. The 2008 EDR should continue to update 2008 ground access conditions on the airport and report on the use of the three new programs to support employees' use of alternative transportation options.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2007, and describes Massport's efforts to reduce noise levels. The technical appendix contains useful and detailed information, while the main text provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring, a point raised by several commenters. The future 2008 EDR represents an appropriate forum to serve this updating function.

2007 was the first full year of operation for Runway 14-32. Consistent with the 2002 Record of Decision (ROD) on the Airside Improvements Planning Project and based on FAA data, the runway was used primarily for arrivals over Boston Harbor during 2007. Consistent with historical patterns, despite the introduction of Runway 14-23, the FAA continued to rely on Logan Airport's north-south traffic flow in 2007. However, within the north-west flow, the FAA increased reliance on Runway 33L for departures with an associated reduction in Runway 27 departures. The changes in runway utilization in 2007 have led to changes in the noise environment. Since 2006, the noise contours over East Boston increased in extent and, over the same period, decreased over South Boston, Revere, and Winthrop.

The population within the 75-80 decibel (dB) DNL contours decreased in 2007 compared to 2006. In 2006, the population in the 75-80 dB DNL contour was 104 but in 2007 zero population was located in this coutour. In 2006, the population in the 70-75 dB DNL contour was 597 compared to 416 in 2007. The overall number of people exposed to Day-Night Sound Level (DNL) values greater than 65 decibels (dB) increased 36 percent compared to 2006. An estimated 7,591 people were exposed to DNL levels greater than 65 dB in 2007, compared to 5,583 in 2006. This is still well below the pre-September 11, 2001, level of 17,745. The residences exposed to DNL levels greater than 65 dB in 2007 are located within the 65 dB sound insulation contour, and thus are within areas that have been sound insulated by Massport. The comments from the Boston Transportation Department, the City of Cambridge as well as from individuals such as Mr. Peter Koff and Ms. Nancy Timmerman have raised a number of concerns and suggestions related to noise that Massport should consider incorporating into the 2008 EDR.

In 2007, Massport provided sound insulation to 548 homes, the majority of which were in Chelsea. Since the inception of Massport's Sound Insulation program, 10,461 homes in East Boston, South Boston, Winthop and Chelsea have received sound insulation.

The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2008 EDR. I also strongly advise Massport to consider and address the comments received that have raised noise related concerns.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2007 and efforts to reduce emissions. The emissions inventory results were driven largely by three factors: changes in the aircraft fleet mix at the Airport (the airlines' substitution of select narrow-body aircraft with wide-body and commuter aircraft); the reported change in the aircraft average taxi/delay times at Logan Airport; and continual improvements to the FAA Emissions and Dispersion Modeling System (EDMS), v5.0.2, particularly in regard to the advanced method for calculating particulate matter (PM) emissions from aircraft engines. Because of the changes to the EDMS model, total modeled emissions of PM10/PM2.5 associated

with Logan Airport in 2007 appeared to have increased by approximately 64 percent to 128 kilograms per day (kg/day) compared to 2006 levels. By comparison, using the EDMS version available in 2006 (v5.0.1) total emissions of PM10/PM2.5 would have increased by approximately 5 percent to 82 kg/day due to a combination of changes in aircraft fleet mix and aircraft taxi/delay time. This data shows that the estimated increase in PM10/PM2.5 was due mostly to the updated EDMS model and not the result of significant changes in Airport operations. Nonetheless, the increases in modeled emissions are notable and I encourage Massport to revisit all feasible efforts to mitigate PM10/PM2.5 emmissions.

The 2007 EDR reports that the total emissions of volatile organic compounds (VOC) were 1,673 kg/day, or 3 percent lower than 2006 levels. Total emissions of carbon monoxide (CO) were 9,233 kg/day, or 13 percent higher than 2006 levels. Total emissions of oxides of nitrogen (NOX) were 4,457 kg/day, or 7 percent higher than 2006 levels. In 2007, total NOx emissions at Logan Airport were approximately 541 tons per year lower than the 1999 Air Quality Initiative (AQI) benchmark which represents a 27 percent decrease in NOx emissions at Logan Airport since 1999. There was also a continuing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MA DEP) monitoring sites located in the general vicinity of Logan Airport. In addition, the annual NO2 concentrations at all monitoring locations in 2007 were within the NO2 Air Quality Standards.

In the 2007 EDR Massport for the first time has voluntarily submitted its first emission inventory of greenhouse gas (GHG) emissions directly and indirectly associated with Logan Airport. "Direct emissions" are those that occur in areas located within the Airport's geographic boundaries and "indirect emissions" are those that occur off the Airport site. "Direct" GHG emissions associated with Logan Airport in 2007 were 0.37 million metric tons (MMT), and the sum of "direct" and "indirect" emissions was 0.69 MMT (less than 0.1 percent of state-wide totals). Massport has control of only 18 percent of these combined totals and will implement plans by 2009 to reduce further GHGs associated with its operations at Logan Airport helping minimize the Airport's carbon footprint.

The 2008 EDR should continue updates on the information presented in the 2007 EDR and address comments received related to air quality. In particular the Mr. Peter Koff has raised several concerns related to air quality monitoring and the Massachusetts Department of Public Health's (DPH) Logan Airport Health Study. The 2008 EDR should clarify this issue and update the status of any air quality monitoring related to this concern.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management.

I note on July 31, 2007, the Environmental Protection Agency (EPA) and MA DEP issued a new National Pollutant Discharge Elimination System (NPDES) Program permit for Logan Airport's stormwater outfalls. The new NPDES permit regulates stormwater discharges from the North, West, Northwest, Porter Street, and Maverick Street Outfalls, and all of the airfield outfalls. The previous NPDES permit regulated stormwater discharges only from the North, West, Porter Street, and Maverick Street Outfalls. The new NPDES permit also has additional sampling requirements, including the requirement to sample for deicing compounds. In 2007, three of 404 outfall samples exceeded the regulatory limits contained in the NPDES permit. The Maverick Street Outfall had two samples exceed the 100 milligrams per liter (mg/L) daily maximum limit for Total Suspended Solids (TSS) and the West Outfall had one sample exceed this limit. This is an improvement compared to 2004 and 2006 when four samples exceeded the regulatory limits, and 2005 when eight samples exceeded the regulatory limits.

In 2007, Massport completed an update to the Airport's Stormwater Pollution Prevention Plan (SWPPP). The SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants. Best management practices (BMPs) are included in the SWPPP. Also in accordance with the Massachusetts Contingency Plan (MCP), Massport continued to assess, remediate, and bring to regulatory closure areas of subsurface contamination. In 2007, Massport worked towards achieving regulatory closure of six remaining MCP sites. Massport should continue to report in the 2008 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Sustainability at Logan Airport

This chapter describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision.

This chapter describes Massport's continued efforts including Massport-wide sustainability and details how sustainability is incorporated into many aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance which are detailed in this chapter. The replacement GA Facility in the North Cargo Area, which was constructed in early 2007 and opened in June 2007, is an example of planning and design sustainability initiatives being undertaken at Logan Airport. The new GA Facility incorporates sustainable design, construction, and operational elements. On the operations and maintenance in 2007, Massport created preferred parking areas in garages and

parking areas throughout Logan Aiport to promote use of lower emitting vehicles. In cooperation with the City of Boston, in the spring of 2007, Massport began a limited head-of-line privilege program for taxis using AFVs, helping to increase the use of alternatively-powered taxis. Additionally, in 2007, Massport created a Cell Phone Waiting Lot, a new parking area where drivers picking up arriving passengers can park for a maximum of 30 minutes. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2008 EDR.

Conclusion

As I stated at the beginning of this Certificate, the 2008 EDR must provide responses to the issues raised in comments received. The 2008 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2007 EDR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, noise abatement, and air quality issues. Massport should consult directly with individual commentors where appropriate.

October 31, 2008
Date

Ian A. Bowles

Comments Received:

10/20/2008 Boston Transportation Department
10/20/2008 Peter L. Koff, Engel & Schultz, LLP
10/24/2008 Stephen H. Kaiser, PhD
10/27/2008 City of Cambridge, Robert Healy, City manager
10/28/2008 Nancy Timmerman

IAB/ACC/acc

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November 13, 2009

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS ON THE 2008 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2008 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: October 7, 2009

As Secretary of Executive Office of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00).

The environmental review process at Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long range plans. It has thus become (consistent with the objectives of the MEPA regulations) part of Massport's long range planning. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific EIRs. The ESPR is currently updated on a 5-year basis, with less detailed Environmental Data Reports (EDR) (formerly Annual Updates) filed in the years between ESPRs. The EDR addressing airport operations during 2008 is the subject of this Certificate.

In general, the EDR has fulfilled its purpose of providing a "snapshot" of year 2008 passenger and impact levels at Logan Airport. Most environmental parameters showed improvement in calendar year 2008. In particular, the technical studies in the 2008 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Mitigation of noise impacts and air quality remain key concerns both of this office and the commenters. These commitments take the form of project-specific Section 61 Findings, as well as more general mitigation that has emerged from the ESPR process.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

The last Logan ESPR was filed for calendar year 2004. Following the recent sequence of annual environmental filings, the environmental filing scheduled for next year was previously anticipated to be in the form of an ESPR rather than an EDR. However, due to the current economic downturn, as described in this 2008 EDR, activity levels at Logan Airport and associated environmental impacts continue to remain well below historic levels and recent peaks. In 2009, near-term activity levels and associated environmental effects are also expected to remain well below levels previously analyzed for Logan Airport. Thus, the forecasted aviation growth presented in the 2004 ESPR, the predicate upon which the ESPR schedule was initially established, has not occurred. Therefore, I will allow Massport to prepare a 2009 EDR in lieu of the scheduled ESPR. The 2009 EDR should address the activity levels observed in 2009 in comparison with those predicted in the 2004 ESPR. The 2009 EDR should explain Massport's proposed schedule for filing the next ESPR in light of observed and expected activity levels and any other changes in airport operations that have occurred since the 2004 ESPR was filed. Where appropriate, Massport must continue to identify and address any longer term aviation and environmental trends in each annual filing whether that will be in the form of an EDR or ESPR.

Review of the 2008 EDR and Scope for the 2009 EDR

Procedural for 2009 EDR

The 2009 EDR must provide an annual update on conditions at Logan Airport for calendar year 2009. The 2009 EDR should continue to serve as a background/context against which projects at Logan Airport can be evaluated. It should also report on the cumulative effects of Logan Airport operations and activities, compared to 2008.

The 2009 EDR must respond to those issues explicitly noted in this Certificate and the comments received in the next EDR. The EDR should provide a "snapshot" of the 2009 operations and impacts, with more substantial analysis awaiting the next ESPR. Massport should file the 2009 EDR no later than October 15, 2010.

A distribution list for the 2009 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan Environmental Status and Planning Report (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary.

Responses to Comments

The comments received on the 2008 EDR are thoughtful and detailed. The 2009 EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2008 EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2009 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commentors where appropriate.

Organization of the Certificate

I have organized the remainder of this Certificate to respond to issues raised roughly in the order in which they were presented in the 2008 EDR, although I have for the most part incorporated discussion of issues raised in the technical appendix into the discussion of the environmental impact analyses.

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2008 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. The total number of air passengers at Logan Airport dropped to 26.1 million from 28.1 million in 2007. The decrease in the total number of air passengers was 7.1 percent. In addition, the total number of aircraft operations declined from 399,537 in 2007 to 371,604 in 2008, a decrease of 7 percent. The 2008 EDR also reports that the passenger aircraft operations decreased by 6.4 percent and operations by general aviation (GA) aircraft also declined by 16.8 percent from 2007. The average domestic load factor (average number of passengers per available seat) for flights also dropped to 72.8 percent, from 74.9 percent in 2007. However, the number of air passengers per aircraft operation was similar to the previous year with an average of 70.2 passengers per aircraft operation in 2008. In response to high and rising fuel prices and declining passenger demand, both low-cost carriers (LCCs) and legacy airlines reduced the number of aircraft operations at Logan Airport. Air cargo volumes, excluding mail, continued to decline from 632 million pounds in 2007 to 588 million pounds in 2008.

For the 2009 EDR, the Activity Levels chapter should include:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Passenger activity levels;
- Cargo and mail activities;
- A comparison of the 2009 aircraft operations, cargo/mail operations, and passenger activity levels to 2008 activity levels; and
- A report on national aviation trends in 2009 and a comparison to trends at Logan Airport.

In addition to reporting the analysis of major activity issues, I advise Massport to consider and attempt to address all comments related to activity levels in the 2009 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2008. It also describes known future planning, construction, and permitting activities. In 2008 the replacement Signature Flight Support GA Facility in the North Cargo Area (NCA) was certified under the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) Green Building Rating System. In addition, several other projects were also completed in 2008. The southwest corner taxiway system was realigned and the northern portion of the centerfield taxiway was constructed and was operational in 2008. Also Phase 1 of the Consolidated Maintenance Facility was constructed in the NCA and Phase 2, involving rehabilitation of the existing Facilities Building Number 2, began. Massport also completed renovations of the existing gas station in the NCA, which included installing Logan Airport's first E85 fuel dispensing tank. (E85 is an alcohol fuel

mixture that typically contains a mixture of up to 85 percent denatured ethanol and gasoline or other hydrocarbon.) In 2008 Massport also completed the final construction of the Bremen Street Park. In addition, a security wall was installed along the perimeter of the air operations area in the North Service Area.

For the 2009 EDR, the Airport Planning chapter should describe the status of planning initiatives for the:

- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

The chapter should also report on the status of public works projects implemented by other agencies within the boundaries of Logan Airport. Massport should continue to assess planning strategies for improving Logan Airport's operations and services in a, safe, secure, efficient, and environmentally sensitive manner.

Regional Transportation

In general, the 2008 EDR has met the requirements with respect to regional transportation issues. This chapter describes activity levels at New England's regional airports in 2008 and updates recent planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2008 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions. The total number of air passengers utilizing New England's primary commercial service airports decreased from 47.2 million in 2007 to 44.4 million in 2008. This represents a passenger traffic decline of 5.9 percent. Activity levels as measured by the number of aircraft operations fell by 7.7 percent, from 1.31 million operations in 2007 to 1.21 million operations in 2008.

The decreases in passenger traffic and aircraft operations at New England airports reflect national trends in the face of volatile fuel prices and a worsening global economy. Specifically, of the 44.4 million air passengers using New England's primary commercial service airports, 59 percent of air passengers used Logan Airport in 2008 and 60 percent in 2007, as compared to 88 percent in 1995. In addition, air passenger traffic in the region fell more quickly than in the overall U.S. domestic market. As reported in the 2008 EDR, airlines introduced major reductions in operations through the year, eliminating less profitable routes and cutting frequencies in smaller markets. Fuel prices also forced airlines to ground less fuel efficient aircraft, as well as aircraft with high per seat operating costs, such as the small regional jets (with 50 seats or fewer) prevalent at the regional airports. As a result, the average number of seats per scheduled flight at the regional airports increased from 84 in 2007 to 88 in 2008. In comparison to 2007 levels, the operations by GA aircraft at New England regional airports declined by 7.6

percent. Declines in GA activity in New England also outpaced declines in the rest of the country. According to the FAA, GA activity fell by 5.6 percent nationally in 2008, due to high fuel costs resulting in a sharp decrease in recreational flying.

The directives in the ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2008 EDR has performed this task.

I direct Massport to continue the directive from the ESPR Certificate for the 2009 EDR. In addition, for 2009 EDR the chapter on Regional Transportation should describe Logan Airport's role in the region's intercity transportation system by reporting on the following related to Regional Airports and Regional Transportation System:

Regional Airports

- 2009 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Ground Access improvements to the regional airports; and
- The role that Worcester Regional Airport and Hanscom Field play in the regional aviation system and Massport's efforts to promote these airports.

Regional Transportation System

- Massport's efforts in strengthening the regional transportation system;
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

Ground Transportation

The 2008 EDR serves its purpose of updating 2008 ground access conditions on the airport, and has also adequately addresses the updating of the three new programs to support employees' use of alternative transportation options.

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2008. Specifically, ground transportation activity levels associated with Logan Airport generally decreased for all surface transportation modes from 2007 to 2008 as a result of a 7 percent decline in the annual number of air passengers. In addition, the average daily traffic on Airport roadways decreased by 13 percent from 2007 to 2008, while vehicle miles traveled (VMT) decreased by 11 percent. This can be attributed directly to a decrease in annual passengers at the Airport. Air passenger ridership on Logan Express bus service also decreased by 14 percent in 2008 compared to 2007. However, Silver Line boardings at the Airport increased 5 percent. The increase in Silver Line ridership is likely due to new ridership as well as diversion from other services, such as from water transportation, limousines, and taxis. Ridership on water transportation decreased by 12 percent, limousine ridership decreased by 19 percent, and taxi

dispatches decreased 9 percent.

The 2008 EDR also documented that over the past several years, transit services have seen substantial increases in employee use. In 2008, the number of employees using Logan Express increased by 7 percent. In 2008, the Logan Transportation Management Association (Logan TMA) continued the operation of three programs that were introduced in 2007: 1) Sunrise Shuttle, which provides shuttle services between 3:00 A.M. and 5:30 A.M. for Airport employees who reside in East Boston; 2) Logan TMA Preferential Carpooling, which provides free parking at the West Garage to employees of Logan TMA member companies who carpool in groups of three or more; and 3) the Commuter Cash program, which financially rewards employees ($3/day) who switch from driving alone to either carpooling, bicycling, walking, or using public transportation. The number of vehicles parked on-Airport decreased by 14 percent in 2008 compared to 2007. The most significant change to the parking supply was the 40 percent reduction of spaces in the Economy Lot due to construction activities during most of the year.

The 2009 EDR should continue to update 2009 ground access conditions on the airport and report on the use of the three new programs to support employees' use of alternative transportation options. The chapter should also report on 2009 conditions and provide a comparison of 2009 findings to those of 2008 for the following:

- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Scheduled, Unscheduled, Water Transportation, and Logan Express);
- Logan Airport Employee Transportation Management Association (Logan TMA) membership and services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT). VMT will be calculated using the updated model created in 2004 that is based on the full build roadway network;
- Parking demand and management (including rates and duration statistics); and
- Ground access management strategy.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2009, and describes Massport's efforts to reduce noise levels. The technical appendix contains useful and detailed information, while the main text provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring, a point raised by several commenters. The future 2009 EDR represents an appropriate forum to serve this updating function.

The decrease in aircraft operations in 2008 led to changes in the noise environment. The 2008 Day-Night Sound Level (DNL) contours were smaller in almost all locations compared to 2007. The 65 decibel (dB) DNL contour decreased in size in East Boston pulling back from

across the Chelsea River to the East Boston waterfront. Over Winthrop and Revere, the DNL 65 dB contour decreased slightly with additional reductions out over Boston Harbor. The population exposed to noise levels greater than DNL 70 dB decreased in 2008 compared to 2007. In 2007, the population exposed to noise levels greater than DNL 70 dB was 416 but in 2008 the number dropped to 249. The overall number of people exposed to DNL values greater than 65 dB decreased 26 percent in 2008 compared to 2007. An estimated 5,968 people were exposed to DNL levels greater than 65 dB as depicted in the 2008 contour, compared to 8,099 in 2007. The residences exposed to DNL levels greater than 65 dB in 2008 are located within the 65 dB sound insulation contour, and thus are within areas that already have been sound insulated by Massport.

In 2008, Massport provided sound insulation to 388 homes, the majority of which were in Chelsea. The focus of this program in Chelsea is to fulfill federal and state mitigation commitments related to the opening of Runway 14-32. Since the inception of Massport's Sound Insulation program, 10,849 homes have received sound insulation in East Boston, South Boston, Winthrop, and Chelsea.

In 2008, Massport continued installing an improved Noise Monitoring System (NOMS). The flight tracking system and all new noise monitors were operational in 2008. Combined with new noise monitor software, the system has an improved capability of correlating measured noise events with individual flight tracks. This has greatly reduced differences between measured and modeled DNL values.

The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2009 EDR. I also strongly advise Massport to consider and address the comments received that have raised noise related concerns. Several commenters have requested further explanation of the reasons for the increased use of Runway 33L for jet aircraft departures and corresponding decrease in use of Runway 27. The comments from the Boston Transportation Department, the Town of Winthrop, the City of Cambridge, as well as from individuals such as Mr. Peter Koff and Ms. Nancy Timmerman have raised a number of concerns and suggestions related to noise that Massport should incorporate into the 2009 EDR.

For 2009 the Noise Abatement chapter should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2009 conditions and compare 2009 conditions to those of 2008 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and any qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) compliance; and
- Flight tracks, including a discussion of the update on the Standard Terminal Automation

Replacement System (STARS) radar and consolidation of the Boston Terminal Radar Approach Control (TRACON) at Merrimac, plus Massport's installation and use of PASSUR data.

The chapter should also report on 2009 conditions and compare those to 2008 conditions for the following noise indicators:

- Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM), and RealContours and RealProfiles, produce an accurate set of Day-Night Sound Level (DNL) noise contours. Adjustments made to account for over-water sound propagation and the propagation of sound to areas of higher terrain will be reported;
- Noise-impacted population;
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of RealContours and RealProfiles;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values;
- Installation and benefits of the new noise monitoring system; and
- Flight track monitoring noise quarterly reports.

The chapter should also report on noise abatement efforts and provide a status update on the new noise and operations monitoring system.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2008 and efforts to reduce emissions. The modeled emissions inventory results were driven principally by three factors: the lower number of aircraft operations at Logan Airport compared to 2007; the reported change in the aircraft average taxi/delay times at the Airport; and continual improvements to the FAA Emissions and Dispersion Modeling System (EDMS), v5.1, which has revised methods for calculating particulate matter (PM) and hydrocarbon (HC) emissions from aircraft engines, and has new functionality of calculating PM emissions from auxiliary power units (APUs). Because of the changes to the EDMS model and decreased air traffic, total emissions of PM10/PM2.5 associated with Logan Airport have decreased by approximately 37 percent to 81 kilograms per day (kg/day) compared to 2007 levels. By comparison, using the earlier version of EDMS total emissions of PM10/PM2.5 would have decreased by approximately 20 percent to 102 kg/day. This difference is attributed to modifications in the EDMS versions.

The 2008 EDR reports that the total emissions of volatile organic compounds (VOC) were 1,208 kg/day, or 28 percent lower than 2007 levels. The total emissions of carbon monoxide (CO) were 8,361 kg/day, or 9 percent lower than 2007 levels and the total emissions of

oxides of nitrogen (NOX) were 4,204 kg/day, or 6 percent lower than 2007 levels. In 2008, total NOx emissions at Logan Airport (net total with reductions) were approximately 656 tons per year (tpy) lower than Massport's 1999 Air Quality Index (AQI) benchmark. This represents a 28 percent decrease in NOx emissions since 1999. The 2008 EDR notes that other contributing factors to the results of the emissions inventory include the change in stationary source fuel usage, and the change in VMT and parking volumes. Air quality initiatives in place at the Airport and other ongoing efforts by Massport to minimize emissions also played a role. For example, there is a continuing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the general vicinity of Logan Airport since 1999. In addition, the annual NO2 concentrations at all monitoring locations in 2008 were well within the National Ambient Air Quality Standards (NAAQS) for NO2.

For the second year, Massport prepared an emission inventory of greenhouse gas (GHG) emissions directly and indirectly associated with Logan Airport. "Direct" GHG emissions are those that occur in areas located within the Airport's geographic boundaries and "indirect emissions" are those that occur off the Airport site. "Direct" GHG emissions associated with Logan Airport were 0.35 million metric tons (MMT), and the sum of "direct" and "indirect" emissions was 0.65 MMT, or less than 1 percent of statewide totals. Massport operations at Logan Airport contribute only 18 percent of these combined totals. GHG emissions in 2008 were 6 percent lower than 2007 levels.

As part of the Section 61 findings for the centerfield taxiway component, the first phase of a two-phase Massport Air Quality Monitoring Study was initiated in September 2007 at ten locations on- and off-airport using both real time and time-integrated methods to measure fine particulates, volatile organic compounds (VOC), carbonyls, black carbon, and polynuclear aromatic hydrocarbons (PAHs). The 2008 EDR states that this first phase commenced in September 2007 and was completed September 2008, with a report summarizing the findings expected to be completed before the end of 2009. Massport has committed to post this report on Massport's website when completed. The study collected ambient data on a variety of air pollutants over a two year period and assessed air quality changes due to the operation of the new centerfield taxiway. Massport should consult with the Massachusetts Department of Public Health (DPH), the Massachusetts Department of Environmental Protection (MassDEP), the City of Boston Environment Department and Boston Public Health Commission (BPHC) to discuss the second phase of the protocol.

The 2009 EDR should continue updates on the information presented in the 2008 EDR and address comments received related to air quality. For 2009 the Air Quality/Emissions Reductions chapter should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The chapter should also discuss analysis methodologies and assumptions and report on 2009 conditions using the most recent versions of the Emissions Dispersion Modeling System

(EDMS) and MOBILE motor vehicle emissions. The chapter should also include:

- Emissions inventory for carbon monoxide (CO);
- Emissions inventory for oxides of nitrogen (NOx);
- Emissions inventory for volatile organic compounds (VOCs);
- Emissions inventory for particulate matter (PM);
- Nitrogen dioxide (NO2) monitoring; and
- NOx emissions by airline.

This chapter should also report on the following air quality initiatives (AQI) for 2009:

- Air Quality Initiative Tracking;
- Massport's and Tenant's Alternative Fuel Vehicle Programs; and
- The status of other Logan Airport air quality studies undertaken by Massport or others.

The Air Quality Chapter should also include an inventory of GHG emissions from Logan Airport in 2009. GHG emissions should be quantified for aircraft, GSE, motor vehicles and stationary sources using emission factors and methodologies outlined in the Greenhouse Gas Emissions Policy and Protocol issued by EEA. The results of the 2009 GHG emissions inventory should be compared to the 2008 results. The 2008 EDR indicates that Massport commissioned a study to evaluate operational, economic and environmental benefits of cogeneration as a way reduce air emissions associated with the Central Utility Plant. If cogeneration is found feasible, energy consumption could be reduced Airport-wide as could the emissions of criteria pollutants (i.e., CO, NOx, etc.) and GHGs. The status of this study is not described. Therefore, an update should be provided in the 2009 EDR.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management. In accordance with the requirements of the current NPDES permit for Logan Airport that was issued on July 31, 2007, Massport and all 27 co-permittees and tenants began preparation of updated Stormwater Pollution Prevention Plan (SWPPP). Massport completed its SWPPP in December of 2007 and tenant SWPPPs were completed in March 2008. Massport's SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants.

The 2008 Annual Certificates of Compliance were submitted to U.S. Environmental Protection Agency and MA DEP in December 2008 for Massport and each co-permittee. Three out of a total of 73 outfall samples exceeded the regulatory limits of the National Pollutant Discharge Elimination System (NPDES) Program permit for the Airport's permitted outfalls. Two out of 23 samples exceeded the limits at the Maverick Street Outfall and one out of 24 samples exceeded a limit at the West Outfall. Over the past five years, the number of samples that exceeded the regulatory limits has ranged from three (2007) to eight (2005). Due to the large

size of the drainage areas and relatively low concentration of pollutants, it is typically not possible to trace exceedances to specific events. Where a known event, such as a spill, is reported, Massport routinely checks the drainage system for possible impacts from the event and takes corrective actions if necessary.

In accordance with the Massachusetts Contingency Plan (MCP), the 2008 EDR reports that Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. The 2008 EDR states that Massport is working towards achieving regulatory closure of the remaining MCP sites. In addition, preparation of the Environmental Management System (EMS) for facilities, where fleet and field maintenance activities are conducted, was on-going in 2008.

For 2009 the Water Quality/Environmental Compliance and Management chapter should report on the 2009 status of:

- National Pollutant Discharge Elimination System (NPDES) Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility
- Jet fuel usage and spills
- Massachusetts Contingency Plan (MCP) Activities
- Tank Management
- Update on the environmental management plan
- Fuel spill prevention
- Future stormwater management improvements (if any)
- Future MCP and tank management activities

Massport should continue to report in the 2009 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Sustainability at Logan Airport

This chapter describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision.

This chapter describes Massport's continued efforts including Massport-wide sustainability and details how sustainability is incorporated into many aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance which are detailed in this chapter. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2009 EDR.

The 2008 EDR outlines how Massport is committed to sustainable practices to help reduce impacts associated with construction. For example, Massport requires contractors to comply with construction guidelines regarding demolition waste recycling, soil reuse, and air emissions from construction equipment. In addition, in 2008, Logan Airport became the first airport in the U.S. to use warm mix asphalt for its airfield pavement (Runway 4R). Warm-mix as opposed to hot-mix asphalt is heated to a lower temperature, which saves energy resulting in 20 percent lower GHG emissions than hot-mix asphalt. It also contains 18 percent recycled material. Another environmental benefit of warm mix asphalt is that it can be applied in a thicker layer, requiring fewer passes with construction vehicles and fewer emissions of associated pollutants.

Massport has several programs in place that contribute to the environmentally sustainable operation and maintenance of Logan Airport and its facilities. Massport also encourages its tenants to do the same. These programs and other sustainability initiatives include developing a policy that states that new development projects obtain certification under the U.S. Green Building Council Leadership in Energy and Environmental Design® (LEED) Green Building Rating System™ and include LEED accredited professionals on the design team. Massport is also establishing and implementing an Alternative Fuel Vehicle Policy (AFV) Policy that requires key personnel to review and consider AFVs when there is a request for a new or replacement vehicle and to select AFVs unless there is a compelling reason not to. In March 2008, Massport installed twenty 10-foot-tall wind turbines on the roof of Logan Office Center. The wind turbines are expected to generate approximately 100,000 kWh annually, or about 2 percent of the building's monthly energy use.

In 2008 Massport completed renovations to the existing gas station in the NCA to include installing an E85 fuel dispensing tank. As discussed earlier in this Certificate, E85 is a first-generation biofuel. Massport also established a bicycle security program with State Police Troopers providing additional patrols on bicycle, which helps to reduce vehicle-related emissions and fossil fuel use. Finally, Massport created preferred parking areas in garages and parking areas throughout Logan Aiport to promote use of lower emitting vehicles. I commend Massport for the existing and planned sustainability measures.

For 2009, this chapter should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have commenced construction. The mitigation commitments were made in the Section 61 Findings for the following projects which should be reported:

- West Garage/Central Garage;
- International Gateway;
- Runway Ends 22R and 33L Safety Improvements;
- Replacement Terminal A; and
- Logan Airside Improvements Planning.

This chapter should also update the status of Massport's mitigation commitments and identify

projects for which mitigation is complete.

Conclusion

I have determined that the 2008 EDR for Logan Airport has adequately compiled with MEPA and that Massport may prepare a 2009 EDR in lieu of a multi-year ESPR for submission in 2010. As I stated at the beginning of this Certificate, the 2009 EDR must provide responses to the issues raised in comments received. The 2009 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2008 EDR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, noise abatement, and air quality issues. Massport should consult directly with individual commentors where appropriate.

November 13, 2009
Date

Ian A. Bowles

Comments Received:

10/26/2009	Peter L. Koff, Engel & Schultz, LLP
10/28/2009	Town of Winthrop, Noise Air Pollution & Airport Hazards Committee
11/05/2009	Nancy Timmerman
11/06/2009	City of Cambridge, Robert Healy, City Manager
11/09/2009	Boston Transportation Department
11/10/2009	City of Boston Environment Department

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November 12, 2010

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
2009 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2009 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: October 6, 2010

As Secretary of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00). The Proponent, the Massachusetts Port Authority (Massport) should submit an Environmental Data Report containing 2010 data no later than October 15, 2011.

The environmental review process at Logan Airport has been structured to occur on two levels: airport-wide and project-specific. With respect to airport-wide impacts, the periodic Environmental Status and Planning Report (ESPR) process has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long range plans. It has thus become part of Massport's long range planning (consistent with the objectives of the MEPA regulations), and a vehicle for analyzing cumulative impacts associated with airport operations. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation

commitments made by Massport in the context of project-specific environmental impact review. In addition, between preparation of each ESPR, Massport also provides more frequent (annual) Environmental Data Reports (EDRs) that contain data for the prior year's airport operations and impacts. EDRS also provide an updating on the status of outstanding mitigation commitments for all airport projects. The EDR addressing airport operations during 2009 is the subject of this Certificate.

In general, the EDR has fulfilled its purpose of providing a "snapshot" of year 2009 passenger and impact levels at Logan Airport. The technical studies in the 2009 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Most environmental parameters showed improvement in calendar year 2009. However, mitigation of noise impacts and air quality remain key concerns both of this office and the commenters. In addition, there appears to be a trend of increased parking demand at the airport that should be carefully monitored by Massport, and which requires a corresponding focus on increasing public transit use. Finally, assessing the cumulative changes in airport operations and impacts associated with several recent Massport projects (e.g., the Consolidated Car Rental Facility, the Green Bus Depot, the East Boston-Chelsea Bypass and the parking consolidation in the North Cargo Area/Robie parcel) should be a priority of the airport-wide impact assessment reports moving forward. I expect that these topics will be addressed by Massport in the 2010 EDR (to be filed by October 15, 2011) as outlined further below. The next ESPR document containing farther-reaching planning and assessment measures will need to be submitted the following year.

Environmental Data Reporting Process

In 1979, the Secretary of the Executive Office of Environmental Affairs issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of periodic ESPR documents (typically every five years) and provides data updates annually through the EDRs.

The last Logan ESPR was filed for calendar year 2004. However, due to the current economic downturn, as described in this 2008 EDR submitted in the October, 2009, activity levels at Logan Airport and associated environmental impacts continued to remain well below historic levels. Therefore it was anticipated that in 2009, near-term activity levels and associated environmental effects were also expected to remain well below levels previously analyzed for

Logan Airport. As a result, the forecasted aviation growth presented in the 2004 ESPR, the predicate upon which the ESPR schedule was initially established, had not occurred. Therefore, I allowed Massport to prepare a 2009 EDR in lieu of the scheduled ESPR.

Massport has indicated in the 2009 EDR that in 2010, near-term activity levels and associated environmental effects continue to remain well below levels previously analyzed for Logan Airport. Because the forecasted aviation growth presented in the 2004 ESPR has not occurred, Massport has requested to delay filing of the next ESPR until 2011. In addition, Massport is also currently in the process of updating its passenger and operations forecast for the next twenty years. Significantly, this data will allow Massport to more accurately project passenger and operation needs that will directly influence planning for future projects at Logan Airport. The data from this forecasting process will not be available in time for filing the next annual report. Therefore, I will allow Massport to prepare a 2010 EDR followed by a 2011 ESPR (which will be filed in 2012, containing data for 2011 as well as more comprehensive analysis of future plans). Given the two-year extension of the original filing deadline for the ESPR document, I expect Massport to ensure that the 2011 ESPR will not be delayed any further.

REVIEW OF THE 2009 EDR AND SCOPE FOR THE 2010 EDR

General

The 2010 EDR must provide an annual update on conditions at Logan Airport for calendar year 2010. It should address the activity levels observed in 2010 in comparison with those predicted in the 2004 ESPR and should also report on the cumulative effects of Logan Airport operations and activities compared to 2009. The 2010 EDR should continue to serve as a background/context against which projects at Logan Airport can be evaluated. Where appropriate, Massport must continue to identify and address any longer term aviation and environmental trends that will impact airport impacts or planning.

The 2010 EDR must respond to those issues explicitly noted in this Certificate and the comments received in the next EDR. The EDR should provide a "snapshot" of the 2010 operations and impacts, while more substantial analysis and longer-range planning are expected to be presented in the next ESPR. Massport should file the 2010 EDR no later than October 15, 2011.

A distribution list for the 2010 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan Environmental Status and Planning Report (issued on August 16, 2006) to provide context for reviewers. In addition, the document should contain copies of any MEPA Certificates issued for projects at Logan airport in 2010. Supporting technical appendices should be provided as necessary.

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2009 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. The total number of air passengers at Logan Airport during 2009 dropped to 25.5 million, compared to 26.1 million in 2008. The decrease in the total number of air passengers was 2.3 percent, compared to a decrease of 7.1 percent in the previous year. In addition, the total number of aircraft operations declined from 371,604 in 2008 to 345,306 in 2009, a decrease of 7.1 percent. The 2009 EDR also reports that the passenger aircraft operations decreased by 3.8 percent and operations by general aviation (GA) aircraft also declined by a dramatic 48.6 percent in 2009. Also the 2009 EDR reports that the cargo operations decreased by 23.2 percent in 2009, compared to 2008.

The EDR presents data indicating that the number of air passengers per aircraft operation increased, from an average of 70.2 passengers per aircraft operation in 2008 to an average of 73.9 passengers per aircraft operation in 2009. The passenger load factor (the percentage of seats occupied by revenue passengers) also increased slightly from 72.8 to 72.9. This reflects greater air carrier efficiency. While legacy airlines, such as Delta Air Lines, Continental Airlines, and US Airways, reduced aircraft operations significantly at Logan Airport, low-cost carriers (LCCs) operations increased by 12.3 percent. In addition to a continuing expansion in service offerings by JetBlue Airways, Logan Airport saw operations for two new LCCs, Southwest Airlines and Virgin America, begin in 2009. In addition, the 2009 EDR reports that the air cargo volumes declined 12.1 percent from 621 million pounds in 2008 to 546 million pounds in 2009. The largest volume decrease occurred in the express/small packages segment.

For the 2010 EDR, the Activity Levels chapter should include:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Passenger activity levels;
- Cargo and mail activities;
- A comparison of the 2010 aircraft operations, cargo/mail operations, and passenger activity levels to 2009 activity levels; and
- A report on national aviation trends in 2010 and a comparison to trends at Logan Airport.

In addition to reporting the analysis of major activity issues, I advise Massport to consider and attempt to address all comments related to activity levels in the 2010 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2009. It also describes known future

planning, construction, and permitting activities. Construction of a 9,300-foot long centerfield taxiway (Taxiway M) was completed and opened in summer of 2009. Also in 2009 Massport continued the permitting for redevelopment of the Southwest Service Area (SWSA) at Logan Airport which includes consolidation of the rental car operations and their shuttle buses into a single coordinated operation that will result in reduced vehicle miles traveled and the associated air emissions. A Final EIR for the project was filed in March 2010, and a Certificate that determined that the EIR adequately and properly complies with MEPA. In addition, in 2009, Massport began the MEPA review process for the proposed Logan Runway Safety Area (RSA) Improvements at Runway ends 33L and 22R. A Draft EIR was submitted on that project in 2010. Preliminary design of a proposed Green Bus Depot for bus maintenance in the North Service Area (NSA) began in 2009 and an expanded ENF for the Green Bus Depot was filed in 2010.

During 2009 Massport published the Sustainable Design Standards and Guidelines (SDSG) for use by architects, engineers, and planners working on capital improvement projects for Massport facilities. The 2009 EDR reports multiple projects in the planning and design phase. Planning commenced for two hangar upgrades. Massport also commenced with Terminal B Garage repair and rehabilitation where solar panel "trees" were installed on the roof. An extension to Taxiway D was completed and the Taxiway G realignment construction commenced.

Planning for the North Service Area (NSA) Roadway Corridor project began. The NSA Roadway Corridor Project coordinates the roadway and urban design vision for North Service Road and Frankfort Street with ongoing design and construction efforts in the NSA. The 2009 EDR reports that the planning commenced for the Logan Airport Parking Deck Project on the Robie Parcel within the North Cargo Area (NCA) with the construction beginning in spring 2010. The NSA Roadway Corridor project will coordinate the NCA Logan Airport Parking Deck Project, East Boston-Chelsea Bypass Project, the SWSA Redevelopment Project, and the NSA Buffer Project to develop a unified utility, roadway, and landscape vision for the NSA roadway corridor between Prescott Street and Neptune Road. Massport has also begun planning for the East Boston-Chelsea Bypass Project, to develop a limited access roadway between Logan Airport and the new Chelsea Street Bridge. An ENF for this project is currently under review by the MEPA Office.

For the 2010 EDR, the Airport Planning chapter should describe the status of planning initiatives for the:

- Roadway Corridor Projects;
- Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

I expect that this chapter will contain a comprehensive discussion about the coordination of parking efforts at Logan in light of the construction of the Parking Deck Project on the Robie Parcel, beyond what was presented in the 2009 EDR (or that such information will be presented elsewhere in the document). The discussion should include information on the use of the new Parking Deck (or a schedule for implementing use) and the corresponding changes in use (e.g., uses that have been shifted or eliminated) of other parking areas at Logan. I understand that data will also be available about parking patterns as a result of ongoing passenger surveys being undertaken by Massport and the results of these surveys should inform the discussions about airport-wide parking operations.

I also note that several of the projects described in the planning chapter of the 2009 EDR are designed, at least in part, to consolidate and direct airport-related traffic to centralized locations and to minimize airport-related traffic on external streets in adjacent neighborhoods. The 2010 EDR should report, to the extent possible, on the status and effectiveness of these cumulative efforts.

The EDR should also report on the status of public works projects implemented by other agencies within the boundaries of Logan Airport. Massport should continue to assess planning strategies for improving Logan Airport's operations and services in a, safe, secure, efficient, and environmentally sensitive manner.

Regional Transportation

In general, the 2009 EDR has met the requirements with respect to regional transportation issues. The directives in the ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2009 EDR has performed this task.

The chapter describes activity levels at New England's regional airports in 2009 and updates recent planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2009 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions.

The decreases in passenger traffic and aircraft operations at New England airports reflect national trends in the face of volatile fuel prices and a worsening global economy. Specifically, of the total number of air passengers utilizing New England's primary commercial service airports, including Logan Airport, decreased from 44.4 million in 2008 to 42 million in 2009. This represents a passenger traffic decline of 5.4 percent. In the region, activity levels as measured by the number of aircraft operations fell by 14.2 percent, from 1.21 million operations in 2008 to 1.03 million operations in 2009. In addition, air passenger traffic at the regional

airports in New England declined, as the challenging operating environment for airlines affected smaller communities disproportionately. Airlines introduced major reductions in operations throughout the year, eliminating less profitable routes and cutting frequencies in smaller markets. LCCs, such as Southwest Airlines and JetBlue Airways, also stopped expanding their operations at regional airports in recent years, and are now instead focusing on expansion in larger air service markets with a strong business travel portfolio.

Massport also reported in the 2009 EDR that there were continued negotiations with the City of Worcester to purchase Worcester Regional Airport. In June 2010, the City of Worcester transferred the airport to Massport for $17 million.

Massport should continue the directive from the ESPR Certificate for the 2010 EDR. In addition, for 2010 EDR the chapter on Regional Transportation should describe Logan Airport's role in the region's intercity transportation system by reporting on the following related to Regional Airports and Regional Transportation System:

Regional Airports

- 2010 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Ground Access improvements to the regional airports; and
- The role that Worcester Regional Airport and Hanscom Field play in the regional aviation system and Massport's efforts to promote these airports.

Regional Transportation System

- Massport's efforts in strengthening the regional transportation system;
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

Ground Transportation

The 2009 EDR serves its purpose of updating 2009 ground access conditions on the airport, and has also adequately addresses the updating of the three new programs to support employees' use of alternative transportation options.

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2009. Specifically, ground transportation activity levels associated with Logan Airport generally decreased for all surface transportation modes from 2008 to 2009 as a result of a 2.3 percent decline in the annual number of air passengers. The 2009 EDR reports that the average daily traffic on airport roadways decreased by 7 percent from 2008 to 2009, while vehicle miles traveled decreased by 5 percent.

Data in the 2009 EDR reports that Massachusetts Bay Transportation Authority (MBTA)

transit ridership to the Airport, including the Blue Line and the Silver Line, increased in 2009. Silver Line boardings at the Airport continued to grow, increasing by 11 percent in 2009 (compared to a 5 percent increase in 2008). In contrast, air passenger ridership on Logan Express bus, by water transportation, and by limousine decreased in 2009. From 2008 to 2009, Logan Express air passenger ridership decreased by 8 percent, ridership on water transportation decreased by 8 percent, limousine ridership decreased by 11 percent, and taxi dispatches decreased 7 percent. The 2009 EDR reports that over the past several years, transit services, including Logan Express, have experienced substantial increases in employee use. In 2009, employee use of Logan Express increased 4 percent over 2008 levels.

Despite improvements in use of the MBTA's Blue Line and Silver Line, the number of vehicles parked on-Airport increased by 11 percent in 2009 compared to 2008. The EDR states that Massport continued to comply with the Logan Airport Parking Freeze, and the document contained copies of Massport's bi-annual Parking Space Inventory reports that are submitted to the Massachusetts Department of Environmental Protection to document Massport's compliance with the Parking Freeze.

The 2010 EDR should continue to update 2010 ground access conditions on the airport and report on the use of the three new programs to support employees' use of alternative transportation options. The chapter should also report on 2010 conditions and provide a comparison of 2010 findings to those of 2009 for the following:

- Detailed description of compliance with the Logan Airport Parking Freeze;
- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Scheduled, Unscheduled, Water Transportation, and Logan Express);
- Logan Airport Employee Transportation Management Association (Logan TMA) membership and services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT). VMT will be calculated using the updated model created in 2004 that is based on the full build roadway network;
- Parking demand and management (including rates and duration statistics); and
- Ground access management strategy.

I am troubled by the increased demand for vehicle parking at Logan demonstrated by the 2009 data reported in the EDR, a concern that I understand is shared by Massport. Although Massport has already dedicated significant resources to encouraging transit use, the increased parking demand data suggest that greater efforts are warranted. The 2010 EDR should report on Massport's efforts in this regard. In addition, I expect that this will be a significant component of the long-range planning efforts Massport is currently undertaking.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2009, and describes Massport's efforts to reduce noise levels. The technical appendix contains useful and detailed information, while the main text provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring. The future 2010 EDR represents an appropriate forum to serve this updating function.

The decrease in the number of aircraft operations in 2009 resulted in changes in the noise environment. The 2009 Day-Night Sound Level (DNL) contours were smaller in many locations compared to 2008. The 65 dB DNL contour decreased in size in East Boston. The contour reduced in size over Winthrop and towards South Boston from Runway 27, but increased slightly north of the Airport over Revere due to an increase in departures from Runway 4R. The contour also increased south of the Airport over South Boston due to an increase in arrivals to Runways 4L and 4R. These changes are due to extended closings of Runway 9-27 for resurfacing in 2009.

In 2009 Massport completed installation of an improved Noise Monitoring System (NOMS). The Era Systems Corporation's (ERA) flight tracking system and all new noise monitors were operational in 2009. Combined with new noise monitor software, the system has an improved capability of correlating measured noise events with individual flight tracks.

The 2009 EDR reports that the overall number of people exposed to DNL values greater than 65 decibels (dB) decreased by 43 percent in 2009 compared to 2008. An estimated 4,335 people were exposed to DNL levels greater than 65 dB, as depicted in the 2009 contour, compared to 7,579 in 2008. This is the first time that the number of people exposed to the 65 dB noise level has been fewer than 5,000 since reporting this data in the EDR format. The total population exposed to noise levels greater than DNL 70 dB decreased from 249 in 2008 to 243 in 2009. There was a reduction of noise for 73 people in Winthrop but an increase of noise for 67 people exposed to greater than DNL 70 dB in Boston. The EDR reports that all of the residences exposed to DNL levels greater than 65 dB in 2009 that have chosen to participate in the soundproofing program have been sound-insulated by Massport. In 2009, Massport provided sound insulation to 83 homes, nearly half of which were in Chelsea. The focus of this program in Chelsea was to fulfill federal and state mitigation commitments related to the opening of Runway 14-32. Since the inception of Massport's sound insulation program, 11,136 homes have been sound-insulated in East Boston, South Boston, Winthrop, Revere, and Chelsea.

The information in this chapter is very informative and I encourage Massport to continue this format in the 2010 EDR. I also strongly advise Massport to consider and address the comments received that have raised noise related concerns. Commenters have requested further explanation of the reasons for the increased use of Runway 33L for jet aircraft departures and corresponding decrease in use of Runway 27. The comments from the City of Cambridge, as well as from individuals such as Ms. Timmerman, P.E., have raised a number of concerns and

suggestions related to noise that Massport should incorporate into the 2010 EDR.

For 2010 the Noise Abatement chapter should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2010 conditions and compare 2010 conditions to those of 2009 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and any qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) compliance; and
- Flight tracks, including a discussion of the update on the Standard Terminal Automation Replacement System (STARS) radar and consolidation of the Boston Terminal Radar Approach Control (TRACON) at Merrimac, plus Massport's installation and use of PASSUR data.

The chapter should also report on 2010 conditions and compare those to 2009 conditions for the following noise indicators:

- Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM), and RealContours and RealProfiles, produce an accurate set of Day-Night Sound Level (DNL) noise contours. Adjustments made to account for over-water sound propagation and the propagation of sound to areas of higher terrain will be reported;
- Noise-impacted population;
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of RealContours and RealProfiles;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values;
- Installation and benefits of the new noise monitoring system; and
- Flight track monitoring noise quarterly reports.

The chapter should also report on noise abatement efforts and provide a status update on the new noise and operations monitoring system.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2009 and efforts to reduce emissions. The modeled emissions inventory results were driven principally by the lower number of aircraft operations at the Airport compared to 2008, and continual refinements to the FAA Emissions and Dispersion Modeling System

(EDMS). The 2009 EDR reports that the total emissions of volatile organic compounds (VOC) were 980 kg/day, or 19 percent lower than 2008 levels. Total emissions of oxides of nitrogen (NOX) were 3,979 kg/day, or 5 percent lower than 2008 levels. In 2009, total NOx emissions at Logan Airport (net total with reductions) were approximately 746 tons per year (tpy) lower than the 1999 Massport's Air Quality Initiative (AQI) benchmark. This represents a 32 percent decrease in NOx emissions since 1999. Total emissions of carbon monoxide (CO) were 7,925 kg/day, or 5 percent lower than 2008 levels. Because of the refinements to the EDMS model and decreased air traffic, total emissions of particulate matter (PM) PM10/PM2.5 associated with operations at Logan Airport have decreased by approximately 12 percent to 71 kilograms per day (kg/day) compared to 2008 levels. By comparison, using the earlier EDMS v5.1 total emissions of PM10/PM2.5 would have decreased by approximately 2 percent to 79 kg/day. This variation is attributed to differences in the EDMS versions.

As part of the Section 61 findings for the centerfield taxiway component, the first phase of a two-phase Massport Air Quality Monitoring Study was initiated in September 2007 at ten locations on- and off-airport using both real time and time-integrated methods to measure fine particulates, volatile organic compounds (VOC), carbonyls, black carbon, and polynuclear aromatic hydrocarbons (PAHs). The 2009 EDR reports that since 1999 there has been a continuing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the general vicinity of Logan Airport. In addition, the annual NO2 concentrations at all monitoring locations in 2009 were well within the National Ambient Air Quality Standards (NAAQS) for NO2. The first phase of a two-phase Massport Air Quality Monitoring Study commenced in September 2007, and was completed September 2008, and a final report will be issued summarizing the findings. The study is collecting ambient data on a variety of air pollutants over a two-year period and will assess air quality changes attributable to the operation of the new centerfield taxiway. The second phase of the study will begin in September 2010 now that the centerfield taxiway is completed and fully operational.

Massport prepared an emission inventory of greenhouse gas (GHG) emissions directly and indirectly associated with Logan Airport. The 2009 GHG emission inventory has been updated incorporating guidance developed by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP). The ACRP guidance was published in April 2009 to be used by airport operators developing an airport specific GHG emissions inventory. While not including emissions from the cruise phase of flight above 3,000 feet, in a change from previous EDRs, the 2009 inventory assigns emissions based on ownership and control boundaries (i.e., emissions and sources associated with Massport, airport tenants and the general public). The vast majority of the emission sources at Logan Airport are owned or controlled by the airlines, other airport tenants, and passenger vehicles. Massport operations contribute only 11 percent of the total GHG emissions for the Airport. Total Logan Airport GHG emissions in 2009 were 14 percent lower than 2008 levels.

Massport has also made attempts to reduce aircraft emissions by working with the FAA to study and implement airfield-improvement concepts and operational changes that may have air quality benefits. Massport promoted such concepts through the Logan Airside Improvements Planning Project Environmental Impact Statement, which recommended physical and operational improvements to Logan Airport including construction of the new Runway 14-32 and centerfield taxiway, and other taxiway improvements. Runway 14-32 became operational in November 2006 and the centerfield taxiway was fully opened in summer 2009. In addition, in coordination with Massport, the Massachusetts Institute of Technology (MIT) completed a detailed survey of pilots at Logan Airport to better understand the use of single engine taxiing and issued a paper in March 2010 which was included in Appendix L. Commenters on the 2009 EDR have requested that Massport increase efforts to encourage the use of single engine taxiing. An update of these efforts should be reported in the 2010 EDR.

The 2010 EDR should continue updates on the information presented in the 2009 EDR and address comments received related to air quality. For 2010 the Air Quality/Emissions Reductions chapter should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The chapter should also discuss analysis methodologies and assumptions and report on 2010 conditions using the most recent versions of the Emissions Dispersion Modeling System (EDMS) and MOBILE motor vehicle emissions. The chapter should also include:

- Emissions inventory for carbon monoxide (CO);
- Emissions inventory for oxides of nitrogen (NOx);
- Emissions inventory for volatile organic compounds (VOCs);
- Emissions inventory for particulate matter (PM);
- Nitrogen dioxide (NO2) monitoring; and
- NOx emissions by airline.

This chapter should also report on the following air quality initiatives (AQI) for 2010:

- Air Quality Initiative Tracking;
- Massport's and Tenant's Alternative Fuel Vehicle Programs; and
- The status of other Logan Airport air quality studies undertaken by Massport or others.

The Air Quality Chapter should also include an inventory of GHG emissions from Logan Airport in 2010. GHG emissions should be quantified for aircraft, GSE, motor vehicles and stationary sources using emission factors and methodologies outlined in the Greenhouse Gas Emissions Policy and Protocol issued by EEA. The results of the 2010 GHG emissions inventory should be compared to the 2009 results.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management. In accordance with the requirements of the current

NPDES permit for Logan Airport that was issued on July 31, 2007, Massport and all 27 co-permittees and tenants began preparation of updated Stormwater Pollution Prevention Plan (SWPPP). Massport completed its SWPPP in December of 2007 and tenant SWPPPs were completed in March 2008. Massport's SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants. The 2009 Annual Certificates of Compliance were submitted to the U.S. Environmental Protection Agency (EPA) and MassDEP on December 28, 2009, for Massport and each co-permittee.

In accordance with the Massachusetts Contingency Plan (MCP), the 2009 EDR reports that Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. The 2009 EDR states that Massport is working towards achieving regulatory closure of the remaining MCP sites. In addition, preparation of the Environmental Management System (EMS) for facilities, where fleet and field maintenance activities are conducted, was on-going in 2009.

In 2009, there were six reportable oil and hazardous material spills detailed in the 2009 EDR. Massport received a Notice of Noncompliance (NON) from the MassDEP on September 18, 2009. The NON listed a total of 13 stormwater discharge samples that exceeded permit limits in the period since the NPDES permit was issued in July 2007. In response to the NON, Massport implemented corrective actions throughout the Airport directed at specific issues identified in the NON, as well as generally reviewing and updating standard practices at the Airport. One of the outfall samples out of a total of 72 samples at the Maverick Street Outfall exceeded the regulatory limits of the NPDES permit for the North, West and Maverick Street outfalls which was reported.

In accordance with the requirements of the NPDES permit for Logan Airport, Massport conducted a water quality study to evaluate the potential biological, chemical, and toxicological impacts of de-icer discharges on Boston Harbor. The study concluded that de-icer discharges do not negatively impact dissolved oxygen levels in the harbor, do not contain materials in concentrations over water quality criteria or toxicological benchmarks, and do not adversely affect the designated uses of the receiving waters.

For 2010 the Water Quality/Environmental Compliance and Management chapter should report on the 2010 status of:

- National Pollutant Discharge Elimination System (NPDES) Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility
- Jet fuel usage and spills
- Massachusetts Contingency Plan (MCP) Activities
- Tank Management
- Update on the environmental management plan
- Fuel spill prevention

- Future stormwater management improvements (if any)
- Future MCP and tank management activities

Massport should continue to report in the 2010 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Sustainability at Logan Airport

This chapter describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision.

This chapter describes Massport's continued efforts including Massport-wide sustainability and details how sustainability is incorporated into many aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance which are detailed in this chapter. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2010 EDR.

The 2009 EDR outlines how Massport is committed to sustainable practices to help reduce impacts associated with construction. For example, Massport requires contractors to comply with construction guidelines regarding demolition waste recycling, soil reuse, and air emissions from construction equipment. In 2009, Massport undertook the 2010 Environmental Benchmarking Survey sponsored by Airport Council International North America (ACI-NA) to assess solar power, purchase of renewable energy, availability of low emission ground transportation, recycling and "green" purchasing.

The new Signature Flight Support GA Facility in the North Cargo Area, opened in 2007, the first LEED certified GA facility in the United States. This GA Facility at Logan Airport is serving as a model for new Signature Flight Support GA facilities around the U.S., including at Chicago O'Hare International Airport. The 2009 EDR also reports on the International Standards Organization (ISO) 14001 standard certification for Massport's Logan Airport Facilities II (vehicle maintenance, landscaping, and snow removal) that was completed in December 2006 and was recertified in December 2009. ISO Certification for Facilities I (Central Heating and Cooling Plant) and Facilities III (Electrical and Structural) is scheduled for 2010.
Massport began construction in 2010 on the new Consolidated Rental Car Facility (ConRAC). It will meet the Commonwealth of Massachusetts "LEED Plus" requirements and strive for LEED Silver level certification or better. The ConRAC will include the infrastructure necessary to accommodate future plug-in stations for electric vehicles and other alternative fuel sources such

as E-85 (ethanol). The ConRAC could accommodate car sharing services, such as ZipCar, at a later date. The ConRAC design includes pedestrian and bicycle accommodations including secure bicycle storage. The facility will include efficient water systems including water reclamation for vehicle wash water, and use of stormwater for non-potable uses such as vehicle washing and landscaping irrigation. At least 2.5 percent of the proposed program's overall electricity needs will be met with solar or wind power, or another form of renewable energy. Rental car companies have pledged to maintain rental car fleets which include hybrid or alternativefuel/ low-emitting vehicles.

In 2009, Massport began a four-year rehabilitation of the Terminal B parking garage, which includes the installation of solar panels on the top parking deck and high efficiency Light-Emitting-Diode (LED) lighting throughout the structure. The use of motion-detecting LED fixtures will use approximately 50 percent less electricity than the existing lighting, reducing existing usage by 2,261,218 killowatt-hours (kWhs) of electricity per year. This, along with other energy conservation measures, will reduce 1,307 metric tons of carbon dioxide (CO_2) the equivalent of not using 3,040 barrels of oil or 148,385 gallons of gasoline annually. The Airport expects a savings of $3.8 million in electrical usage over the next 20 years based on costs of $0.12 per kWh. Additionally, the installation of 16 solar panel trees is expected to produce 83,980 kWhs of electricity, or 2.5 percent of the total garage annual consumption. This is equal to the reduction of 50 metric tons of CO_2 the equivalent of not using 115 barrels of oil or 5,637 gallons of gasoline annually. Each solar panel is a single structure design with a stem and steel frame that uses solar panels as a roof over parked cars. The design has the added benefit of collecting rainwater that will be used for landscaping and cleaning projects on the Airport. Each solar array is mounted on an air ventilation unit on the roof of the garage and does not affect parking operations or the number or spaces available to travelers.

For 2010, this chapter should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have commenced construction. The mitigation commitments were made in the Section 61 Findings for the following projects which should be reported:

- West Garage/Central Garage;
- International Gateway;
- Runway Ends 22R and 33L Safety Improvements;
- Replacement Terminal A;
- The Consolidated Rental Car Facility; and
- Logan Airside Improvements Planning.

This chapter should also update the status of Massport's mitigation commitments and identify projects for which mitigation is complete.

Responses to Comments

The 2010 EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2009 EDR focused on noise related issues, including measurement of noise, modeling of noise contours, and noise abatement, and emission reduction issues. In addition to responding to these comments, the 2010 EDR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commentors where appropriate.

Conclusion

I have determined that the 2009 EDR for Logan Airport has adequately compiled with MEPA and that Massport may prepare a 2010 EDR in lieu of a multi-year ESPR for submission in 2011.

November 12, 2010
Date

Ian A. Bowles

Comments Received:

11/04/10	Darryl Pomicter (email)
11/05/10	Nancy Timmerman
11/05/10	City of Cambridge, Executive Department
11/09/10	Jerome Falbo

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Comment Letters and Responses

- The eight comment letters received by the Massachusetts Environmental Policy Act (MEPA) Office on the *2010 Environmental Data Report (2010 EDR)* are reprinted here in the order shown below. As requested in the Secretary of the Executive Office of Energy and Environmental Affairs' Certificate, Massport has provided responses to substantive comments raised in the following letters:
  - Maura Zlody, City of Boston Environment Department
  - Robert D'Amico, City of Boston Transportation Department
  - Robert Healy, City of Cambridge
  - Vivien Li, The Boston Harbor Association
  - Aaron Toffler, Esq., AIR, Inc.
  - Stephen Kaiser, PhD., Cambridge community member
  - Darryl Pomicter, member of the Citizen Advisory Committee (Emails dated December 9, 2011 and November 10, 2012)
  - Nancy Timmerman, P.E., consultant in Acoustics and Noise Control

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December 15, 2011

Richard K. Sullivan, Jr., Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, Massachusetts 02114

Re: Boston-Logan Airport 2010 Environmental Data Report - EEA #3247

Dear Secretary Sullivan:

The City of Boston Environment Department has reviewed the Boston-Logan Airport 2010 Environmental Data Report (EDR) filed by the Massachusetts Port Authority (Massport) for Boston-Logan International Airport (Logan) and offers the following comments.

Massport has asked that the next filing, a 2011 Environmental Status and Planning Report (ESPR), be submitted to MEPA in Spring 2013. This department would support an extension for a full report should a response to comments and requested information be provided by Spring 2012. **B-1**

We thank Massport for providing a CD of this EDR and also making it available on the Massport Web site.

Section 61 Mitigation Measures
Massport is subject to numerous mitigation commitments for past and current/upcoming projects. The following are currently of particular interest to this department.

Regional Transportation Policy commitments

- Engage in promoting increased utilization of regional airport Cooperative transportation planning with the various transportation agencies to ensure an integrated regional transportation infrastructure, i.e., improved highways, public transportation, high-speed rail, private transportation services to improve regional airport access.

Massport identifies this commitment as implemented and states in the EDR that, "During 2001, Massport, together with the FAA and the six New England Regional State Aviation Directors developed a scope of work and selected a technical team to undertake the New England Regional Aviation System Plan (NERASP) Update study. In 2002, the Massport Board approved 10 percent funding with a 90 percent federal match toward the $1.6 million study."

- Continue to work with FAA/regional airport directors to complete a New England Airports System Study to evaluate regional airports performance.

Massport indicates that the NERASP Study as published in October 2006; it considers this measure to be implemented.

In numerous filings with MEPA, Massport has cited its work on the NERASP Study and has referenced it as the basis for conclusions. We have requested several times that Massport provide the report as an Appendix **B-2**

B-2 con't. and be specific about findings and their basis when the study is cited. We reiterate this request.

Logan TMA Participation

- Massport will seek to develop, coordinate, and implement effective TDM strategies to reduce the number of single-occupant trips made by all Logan Airport employees.
- Report on Progress of Logan TMA.
- Massport will encourage participation by all employees, but will particularly target the airport's largest employers.

B-3 Massport identifies these commitments as implemented but there is no information in the EDR regarding the current status of employer participation in the TMA or the current status of the TMA and its members. Given the challenges the TMA has encountered and its importance in maximizing non-auto commuting, we believe that an update of the current situation and expected future of TMA membership and programs should be provided and that this Finding be considered Ongoing rather than Implemented.

Operational Mitigation Measures

- Using single engine taxiing and pushback to the extent feasible and practicable, recognizing that such use always at the discretion of the pilot in charge of the aircraft based upon his or her experience and safety and operational considerations.

B-4 We applaud Massport for engaging MIT in studies of single-engine taxiing and pushback rate control. We understand that Massport will continue to survey airlines periodically about single-engine taxiing. The status of pushback rate control is not discussed; we would welcome an update and discussion.

Activity Levels

Significant changes in activity at Logan Airport in 2010 include the following:

- The total number of air passengers increased by 7.5 percent to 27.4 million. The historic peak passenger level was 28.1 million in 2007.
- The total number of aircraft operations grew from approximately 345,310 in 2009 to 352,640, an increase of 2.1 percent.
- Passenger aircraft operations, which represent 94.1 percent of overall operations, decreased by 1.6 percent compared to 2009 levels. Their levels had declined by 48.6 percent between 2008 and 2009.
- General aviation (GA) operations increased 19.9 percent in 2010, due to increased business travel and use of GA transportation. GA accounted for 4.2 percent of aircraft activity at Logan Airport in 2010.
- The number of air passengers per aircraft operation continued to increase, climbing from an average of 73.9 passengers per aircraft operation in 2009 to an average of 77.8 passengers per aircraft operation in 2010. The number of International passengers decreased slightly over 2009 levels.
- While legacy air carriers continued to reduce the number of aircraft operations at Logan Airport, low-cost carrier (LCC) operations increased by approximately 40 percent in 2010. The increase in operations by LCCs, primarily JetBlue Airways and Southwest Airlines, accounted for nearly all of this growth.
- Dedicated air cargo operations decreased by 5.8 percent compared to 2009.
- Even though the number of dedicated air cargo aircraft operations decreased in 2010, air cargo volumes increased from 546 million pounds in 2009 to 572 million pounds in 2010, an increase of 4.7 percent.

Planning

- Southwest Service Area (SWSA) Redevelopment Program - Construction of this project began in July 2010.
- Logan Runway Safety Area (RSA) Improvements Project at Runway Ends 33L and 22R - Construction of the Runway 33L RSA improvements commenced in June 2011.

- Green Bus Depot - Preliminary design of a bus maintenance facility for Massport's clean fuel fleet buses in the North Service Area (NSA) began in 2009; construction is now underway.
- East Boston-Chelsea Bypass Project - Planning for the East Boston-Chelsea Bypass project commenced to develop a limited access roadway between Logan Airport and the new Chelsea Street Bridge. The Bypass roadway is expected to improve commercial vehicle access to the Airport, as well as reduce congestion on local East Boston streets in the vicinity of Day Square, Eagle Square, and the Neptune Road corridor by directing airport-related commercial traffic to the new Bypass roadway. An ENF was filed on October 15, 2010; on December 1, 2010, the EEA Secretary, in his Certificate, determined that no further MEPA review was required. Construction is underway as of the date of this filing.
- Logan Airport Parking Deck Project - Planning for the Logan Airport Parking Deck Project (Economy Garage) along Prescott Street in the North Cargo Area (NCA) was initiated in 2010. In response to a Massport request, the MEPA Office confirmed that the project was not subject to MEPA review. Construction of the economy garage began in summer of 2010 and was completed and fully opened to the public in early 2011. Solar panel "trees" were installed on the roof of the parking deck, and energy-efficient lighting was also installed throughout. Reporting required by the EEA Secretary is provided in *Chapter 5, Ground Access to and from Logan Airport,* and further details of its energy-saving features are provided in this chapter.
- North Service Area (NSA) Roadway Corridor Project - Massport anticipates completing the project with final landscaping in 2011. The NSA Roadway Corridor Project is not a new roadway but a corridor improvement project. This project is intended to unify the existing roadway with new landscape and urban design elements along this highly visible roadway corridor, providing an important public edge along the corridor. The project will coordinate with other projects including the Logan Airport Parking Deck Project, entrance to the East Boston-Chelsea Bypass Project, and interface with the Neptune Road Buffer Project. The NSA Roadway Corridor extends approximately from Building 11 up to and including Neptune Road. Construction of the NSA Roadway Corridor Project began in 2010. Most of the project's infrastructure, including curbing, sidewalks, lighting and fencing have been installed.
- Hangar Upgrade Projects - Architectural design commenced in December 2010 for two hangar upgrades in the NCA.
- Terminal B Garage Improvement Project Terminal B Garage repair and rehabilitation continued in 2010. In addition to overall upgrades, 32 solar panel trees (200 kilowatt (kW)) were installed on the top floor and the entire garage was fitted with high efficiency Light-Emitting-Diode (LED) lighting.
- Taxiway G Realignment Project - Taxiway G realignment construction was completed in 2010.

Regional Transportation

In 2010, New England's commercial service airports included:

- Logan Airport
- Bradley International Airport, Connecticut (CT)
- T.F. Green Airport, Rhode Island (RI)
- Manchester-Boston Regional Airport, New Hampshire (NH)
- Portland International Jetport, Maine (ME)
- Burlington International Airport, Vermont (VT)
- Bangor International Airport (ME)
- Tweed New Haven Airport (CT)
- Portsmouth International Airport at Pease (NH)
- Worcester Regional Airport, Massachusetts (MA)
- Hanscom Field (MA)

The total number of air passengers utilizing New England's commercial service airports, including Logan Airport, increased from 42.0 million in 2009 to 43.1 million annual air passengers. This represents an increase of 2.5 percent, which is in line with an overall increase of 2.4 percent in the U.S. passenger market.

The challenging airline operating environment affected smaller communities disproportionately. Within the region, Logan Airport passenger traffic grew, while air passenger levels continued to decline at the other regional airports. Of the 43.1 million air passengers using New England's commercial service airports in 2010, 63.6 percent of air passengers used Logan Airport compared to 56.4 percent in 2005. Passenger levels at the regional airports declined by 5.2 percent in 2010, compared to an increase of 7.5 percent at Logan Airport. This was largely due to legacy carriers withdrawing from smaller secondary markets and reducing their use of small regional jets, and LCCs, such as Southwest Airlines and JetBlue Airways, focusing on expansion in larger air service markets with a strong business travel portfolio like Logan Airport.

Aircraft operations in the New England region remained largely flat, increasing slightly by 0.7 percent, from 1.03 million operations in 2009 to 1.04 million operations in 2010. Commercial airline operations declined by 0.25 percent while GA and military operations increased by 1.9 percent and 4.7 percent, respectively.

B-5 Table 4.3, *Share of Scheduled Domestic Departures – Logan Airport and the Ten Regional Airports*, show Logan' s numbers from 2005-2010 then group other airports – cumulative numbers are reported for Bradley, Manchester-Boston and T.F. Green with another set of cumulative numbers for Bangor, Burlington, Hanscom, Portland, Portsmouth, Tweed-New Haven and Worcester. There is no explanation for reporting cumulative data. Given their individual roles in regional transportation, data for each airport should be reported individually.

Massport indicates that in 2010 it continued to engage in cooperative metropolitan planning efforts including GreenDOT, the Healthy Transportation Compact, and the Boston Metropolitan Planning Organization (Boston MPO), also known as the Metropolitan Area Planning Council (MAPC).

B-6 As we have previously requested, Massport should provide information in EDRs/ESPRs about the goals of each planning effort, the specific activities of each effort and details about the role that Massport has played in each.

Massport's Hanscom Field (BED) is located in Bedford, MA, approximately 15 miles northwest of Logan Airport; it is New England's premier facility for business/corporate GA. Hanscom Field serves as a GA reliever airport for Logan Airport, accommodating a variety of GA operations. In 2010, there were 161,940 aircraft operations at Hanscom, approximately eleven times the number of GA operations that occurred at Logan. In addition to its role as a GA facility, Hanscom has also accommodated niche commercial airline services in the past. However, Hanscom Field lost all scheduled commercial service at the beginning of 2008 when Boston-Maine Airways discontinued services to Portsmouth and Trenton. Linear Air, an air taxi charter company, provides private air transportation from Hanscom Field to cities throughout the Northeast and eastern Canada. Streamline currently provides scheduled charter service between Hanscom and Trenton, New Jersey (NJ). Table 4-1, *Passenger Activity at New England Regional Airports and Logan Airport*, show that Hanscom had 0.02 million passenger levels in 2005, 2006 and 2007 and 0.00 in 2008, 2009 and 2010.

B-7

Information on operations by Streamline and Linear Air should be provided, now and in EDRs/ESPRs, as should a description of Massport's efforts attract and retain niche commercial service at Hanscom.

Ground Transportation
Key findings for On-Airport Transportation include:

- The total number of annual air passengers at Logan Airport increased 7.5 percent to 27.4 million, compared to 25.5 million in 2009. During the same period, average daily traffic on airport roadways increased by 5.1 percent from 2009 to 2010, while VMT on the Airport increased by 4.8 percent.
- The number of vehicles parked on-Airport (measured by the revenue parking exits) increased by 4 percent in 2010 compared to 2009 levels.

Massport began construction of the Logan Airport Parking Deck Project, located on the 1,000-space Economy Lot in the NCA. It consolidates an additional 2,000 commercial parking spaces from various on-airport temporary commercial parking lots into a single structured parking facility containing

- approximately 3,000 commercial parking spaces. The garage maintains on-airport parking capacity in compliance with the limits imposed by the Logan Airport Parking Freeze. The garage was fully opened in March 2011.

Key findings for Ground Access Activity include:

- Ground access activity to Logan Airport generally increased for all modes from 2009 to 2010 as a result of a 7.5 percent growth in the number of annual air passengers, as described in Chapter 2, Activity Levels.
- In 2010, Massport administered the periodic Logan Airport Air Passenger Ground Access Survey (Survey). Massport identifies the Survey as its primary tool for understanding the changes in ground access patterns and the effectiveness of its policies and services.
- Passenger origins remain similar to those identified in the 2007 Survey while weekday market share of business trips decreased.
- The 2010 Survey indicates that shares of high-occupancy vehicles (HOV) modes to the Airport have returned to 2004 levels (30 percent HOV mode share); the 2007 Survey had shown a 2 percent decrease.
- Metropolitan Bay Transportation Authority (MBTA) Silver Line boardings at the Airport continued to grow, increasing by 5 percent in 2010, while Blue Line boardings at Airport Station decreased slightly compared to 2009.
- In 2010, ridership on water transportation to the Airport increased by about 1 percent in comparison to the previous year.
- Limousine ridership increased by an estimated 16 percent, and taxi dispatches increased 12 percent in 2010 compared to 2009. Despite the increase in dispatches, the relative share in the use of these modes did not increase, according to the 2010 Logan Airport Air Passenger Ground Access Survey.
- Over the past several years, transit services, including Logan Express bus service, have experienced increases in employee use. In 2010, Logan Express air passenger ridership increased by about 1 percent compared to 2009 levels, whereas employee use of Logan Express increased by 4 percent, and accounts for 42 percent of the service's ridership during this time period.
- Taxi dispatches increased by 12.1 percent in 2010 over the 2009 level.

Logan Express

- Framingham use was up 3.2 percent in 2010 after reductions of 9.4 in 2008 and 2.9 percent in 2009.
- Braintree was up 3.8 percent in 2010 after 4.8 and 1.7 percent decreases in 2008 and 2009, respectively.
- Woburn use was up 3.0 percent in 2010 after having been down 7.4 percent in 2008 and 6.7 percent in 2009.
- The use of Peabody down 13.8 percent in 2010, having been down 2.9 percent in 2008 and 2.3 percent in 2009.
- Overall use as down 2.4 percent in 2010 after reductions of 6.7 percent in 2009 and 3.2 in 2008.
- The majority of 2010 increases in the use of Framingham, Braintree and Woburn were the result of employee use. The 2010 reduction in use of the Peabody service came mainly from employees.

The increases in Logan Express use are less than half of the increase in passengers. We would appreciate Massport's perspective about the 2010 use levels in relation to passenger level increases. **B-8**

Table 5-8, *Ground Access Mode Share (All Passengers) by Survey Year*, shows that the total Non-HOV/Automobile (private automobile, taxi and rental car) shares were:
1999 – 69.3 percent **2004** – 69.7 percent **2007** – 72.3 percent and **2010** – 70.1 percent

Private automobile use has increased from 36.5 percent in 1999 to 70.1 percent in 2010, taxi use has decreased from 20.6 percent in 1999 to 18.8 percent in 2010 and rental car use has increased from 69.3 percent in 1999 to 70.1 percent in 2010.

Total HOV/Shared-Ride (unscheduled HOV, scheduled HOV, transit, courtesy shuttle and an unspecified "other") numbers were:
1999 – 8.9 percent **2004** – 30.3 percent **2007** – 27.8 percent and **2010** – 29.9 percent
We note that HOV use during the period from 2004-2010 was at its lowest during 2007, the year in which passengers levels reached an historic high.

Unscheduled HOV use has decreased from 8.9 percent in 1999 to 7.5 percent in 2010; it increased slightly in 2010 from 2007 numbers.

Scheduled HOV use decreased from 9.5 percent in 1999 to 8.2 percent in 2010, transit use has declined from 9.7 percent to 7.6 percent in 2010, Courtesy Shuttle use has increased from 2.1 percent in 1999 to 4.6 percent in 2010 and "Other" has increased from 0.5 percent in 1999 to 1.8% percent in 2010.

B-9 We ask that Massport explain the information and conclusion reached regarding limousine ridership. What is the method for estimating ridership (16 percent increase in 2010) and how was the conclusion reached that the 2010 Survey data revealed no increase in relative share?

It is important to know, in general, which data on ground transportation is estimated and which is based upon a measured method. In addition, definitions of scheduled and non-schedule HOVs and the 'other' category need to be clarified.

B-10 This department has requested several times that the Survey used by Massport be provided in the appropriate EDR or ESPR subsequent to its administration and that the response rate be provided. We ask that this be provided in interim information and in future filings with MEPA.

A preferred parking program for hybrid and alternative-fueled vehicles (AFVs) in the Spring of 2007. Designated parking spaces at the Airport's Central Garage, Terminal B garage, Terminal E surface lot, and Economy Parking. The new Logan Airport Parking Deck Project also provides preferred parking spaces for AFVs.

B-11 We request that Massport provide information on the marketing and utilization rate of these spaces.

Massport offers guaranteed parking through its Parking PASSport Gold program. Parking PASSport GOLD and Parking PASSport allow users to enter and exit Logan Airport's parking garages and lots with an access card that is linked to an established account for faster payment transactions. Parking fees are automatically charged to a registered credit card and the receipt is emailed to the account holder. Parking PASSport Gold is offered in dedicated areas of the Terminal B and Central Parking garages, eliminating the need for a motorist to circle the garage looking for available spaces. First implemented in 2006, the Parking PASSport GOLD program had 4,565 customers as of December 31, 2010, compared to 3,631 at the end of 2009. Customers in the Parking PASSport programs account for roughly two percent of parking exits at Logan Airport.

B-12 While minimizing the time it takes for motorists to find a parking space is good for local air quality, this program may encourage air passengers to drive to Logan so it is not a measure designed to encourage HOV use.

We applaud Logan for the Cell Phone Waiting Lot.

Logan Airport Employee Transportation
Airport employee transportation has different ground access considerations than passenger transportation. Airport employees often have non-traditional and unpredictable working hours which are difficult to match to typical transit service hours. Due to the time-sensitive nature of airline operations, on-time reliability is

important for employee transportation, as is flexibility during severe weather or other delays which may extend a typical employee workday.

Massport provides off-airport employee parking in Chelsea, which is served by frequent shuttle bus service to the terminals; runs free employee shuttle buses between Airport Station and employment areas in the SWSA and South Cargo Area (SCA) locations; operates early morning Logan Express bus trips for early commuters; supports the Logan Transportation Management Association (TMA); creates and maintain a sidewalks to facilitate pedestrian access; and provides bicycle racks.

The Massachusetts Department of Transportation's (MassDOT) Office of Transportation Planning, through its Mass*RIDES* program, is the coordinator for the Logan TMA. Mass*RIDES*'s administrative support for the Logan TMA allows Massport to use its financial resources to support transportation demand management (TDM) services. Massport contributes $65,000 annually to the Logan TMA. Massport also provides space and equipment for the Logan TMA office (The Transportation Store) in Terminal C.

The Logan TMA advises Airport employers on transit benefits and provides information on available commuting transportation alternatives, ride-matching services, and reduced-rate HOV/transit fare options. It works with airlines, rental car companies, cargo transport companies and other tenants at Logan Airport to encourage and offer commuting incentives to employees. Several companies offer a subsidy to employees using public transit or Logan Express to travel to work at the Airport. The TMA is open to all companies and their employees at Logan Airport; all employees are eligible to benefit from its services.

Benefits and services provided by the Logan TMA to Logan employees in 2010 included:

- East Boston early morning shuttle service (Sunrise Shuttle), a low-cost efficient transportation to airport employees who live in East Boston. It operates outside of MBTA service hours, between 3:00 AM and 6:00 AM, with half-hourly shuttles transporting employees between various East Boston locations and the terminals. The ridership level increased from 425 riders per month in 2009 to 636 per month in 2010.
- Computerized ride-matching services for participating in carpools and vanpools.
- Individualized commuter mobility programs for member organizations designed to decrease employee dependence on the automobile.
- Airport-wide and individual employer events, such as Transportation Awareness Day, to disseminate information about Logan TMA services.
- Advocacy for improved service and reduced fares for its members from Massport, the MBTA, or other providers of mass transit and other alternative forms of transportation.

As stated earlier in these comments, we believe that the current and expected future situations with TMA membership and programs should be provided and that this Finding be considered Ongoing rather than Implemented. **B-13**

Noise

- The 2010 Day-Night Sound Level (DNL) contours are similar in size compared to 2009. The DNL 65 decibel (dB) contour remained the same in Revere and in most of Winthrop. The extent of the DNL 65 dB contour decreased slightly in the Point Shirley section of Winthrop due to the reduced number of departures from Runway 9 and due to the reduced number of aircraft arrivals over South Boston and East Boston. The geographic extent of the DNL 65 dB contour increased in East Boston near the Airport and out over Boston Harbor due to an increase in departures from Runway 15R.
- This *2010 EDR* reports on the findings of the Integrated Noise Model's (INM) results of the population impacted by airport related noise and used both the 2010 and 2000 Census data as a basis for comparison.
- Using the 2000 Census, the overall number of people exposed to values greater than DNL 65 dB decreased by 11 percent in 2010, compared to 2009. An estimated 3,870 people were exposed to levels greater than DNL 65 dB as depicted in the 2010 contour, compared to 4,335 in 2009. This is

the first time that the number of people exposed to the DNL 65 dB noise level has been fewer than 4,000 and that the number of people within the DNL 65 dB in Boston has dropped below 1,000 to 711 people.

- Using the 2000 Census, the total population exposed to noise levels greater than DNL 70 dB decreased in 2010 compared to 2009. In 2009, the total population greater than DNL 70 dB was 243, and in 2010 the number dropped to 198. There was a reduction of 40 people in Winthrop and a decrease of 5 people exposed to greater than DNL 70 dB in Boston, resulting in the drop in the total impacted population.
- Using the 2010 Census, the overall number of people exposed to DNL values greater than 65 dB decreased to 3,830 people, 40 people fewer than with the 2000 Census. Within the DNL 70 dB contour the number of people has dropped to 130, 68 fewer than with the 2000 Census. Due to the updated population and Census block boundaries of the 2010 Census, there were no people within the DNL 70 dB contour in the City of Boston.
- In 2010, Massport provided sound insulation to 83 homes, nearly half of which were in Chelsea. The focus of this program in Chelsea was to fulfill federal and state mitigation commitments related to the opening of Runway 14-32. Since the inception of Massport's Sound Insulation program, 11,219 homes have been received sound insulation treatment in East Boston, South Boston, Winthrop, Revere, and Chelsea.

Methods used to reduce noise include:

- Residential sound insulation program, begun in 1986.
- RNAV flight tracks designed to avoid highly populated areas.
- Overwater visual approach at night to keep aircraft offshore as much as possible.
- Runway choices based upon dictated or permitted by availability, wind, weather, aircraft performance, demand, and air traffic control conditions.

B-14 This department receives phone calls from residents of East Boston who participated in the early sound insulation/room-of-choice program and finding that windows have reached their useful life, some because of the effects of vibration, and are no longer providing the original level of benefit. It may be that a limited lifespan was not a subject of consideration when the program was implemented. We ask that Massport discuss this issue.

We note that when PRAS was in place, runway use goals were not obtained and, although the aforementioned reasons for runway choices are clearly necessary factors, pilot preference not based upon the those factors is also a reason for runway use choices.

Noise Complaints

In 2010, Massport received a total of 3,761 noise complaints from 53 communities, a decrease of 35.9 percent from 2009, when the Noise Abatement Office received 5,869 complaints. A full listing of complaints by community shows that five communities had more than 100 complaints from an individual caller, and East Boston had more than 100 complaints from two callers. Among communities with more than 100 annual complaints, the greatest increases were Jamaica Plain (up from 93 in 2009 to 158 in 2010), Lynn (up from 154 to 339), Somerville (up from 325 to 385), and Weymouth (up from184 to 193). There were three communities that had an increase of at least 30 complaints but a total of less than 100: Milton (up from 54 in 2009 to 84 in 2010), Roslindale (up from 4 to 73) and South Boston (up from 26 to 59). Seven communities with more than 100 annual complaints in 2009 had a decrease in noise complaints for 2010: Cambridge (down from 471 in 2009 to 323 in 2010), Chelsea (down from 570 to 129), East Boston (down from 1,657 to 699), Marshfield (down from 228 to 13), Medford (down from 504 to 444), Nahant (down from 400 to 204), and Winthrop (down from 513 to 207).

B-15 ESPRs/EDRs include no information about noise complaints other than their numbers and the neighborhood or municipality of the complainants. It would be useful to know how complaints break down on these

parameters:

- arrival or departure;
- month;
- day of week;
- time of day;
- runway;
- type of aircraft; and
- the determination of aircraft compliance with prescribed flight tracks.

B-15 con't.

Air Quality/Emissions Reduction
Total emissions of volatile organic compounds (VOC) were 1,019 kilograms per day (kg/day), or 4 percent higher than 2009 levels, but still follow a long-term, downward trend decreasing by almost 78 percent since 1990. This increase is primarily due to the increase in landing and takeoff operations (LTOs) when compared to 2009.

Total emissions of oxides of nitrogen (NOX) were 3,989 kg/day, or less than 1 percent higher than 2009 levels. In 2010, total NOx emissions at Logan Airport (net total with reductions) were approximately 742 tons per year lower than Massport's 1999 Air Quality Initiative (AQI) benchmark. This represents a 32 percent decrease in NOx emissions since 1999.

Total emissions of carbon monoxide (CO) were 7,160 kg/day, or 10 percent lower than 2009 levels.

Mostly due to the decreased use of No. 6 fuel oil, total emissions of particulate matter (PM) PM10/PM2.5 associated with Logan Airport heating and cooling decreased in 2010 by approximately 10 percent to 64 kg/day compared to 2009 levels.
Since 1999, there has been a continuing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the vicinity of Logan Airport. In addition, the annual NO2 concentrations at all monitoring locations in 2010 continued to be well within the National Ambient Air Quality Standards (NAAQS) for NO2.

Massport's two-phased Air Quality Monitoring Study is collecting data on a variety of ambient air pollutants over a two year period and assessing air quality changes attributable to the operation of the new centerfield taxiway. The second phase of the Study concluded in 2011; after the centerfield taxiway became fully operational. The findings from this Study will be submitted to MassDEP in late 2011/early 2012 and also will be reported in the *2011 ESPR*.

2010 marks the fourth consecutive year in which Massport has voluntarily prepared a MEPA greenhouse gas (GHG) emissions inventory for the EDR. The 2010 GHG emission inventory was updated incorporating guidance developed by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP). The ACRP guidance was published in April 2009 for airport operators developing an airport-specific GHG emissions inventory.12 The 2010 inventory assigns emissions based on ownership or control (e.g., Massport, airlines and other airport tenants, and the general public). The vast majority of emission sources at Logan Airport are owned or controlled by the airlines, airport tenants, and the general public (through emissions from motor vehicles). Massport sources contribute 12 percent of the total GHG emissions for the Airport. Total Logan Airport GHG emissions in 2010 were slightly lower (0.4 percent) than 2009 levels.

We note that the Massachusetts Department of Public Health Study has not yet been released and will have data to supplement current knowledge.

Water Quality/Environmental Compliance and Management

- In 2010, there were 15 oil and hazardous material spills that required reporting to MassDEP, five of which involved a storm drainage system.

- One outfall sample out of a total of 19 samples at the Maverick Street Outfall and one outfall sample out of a total of 23 samples at the North Outfall exceeded the regulatory limits of the National Pollutant Discharge Elimination System (NPDES) Permit for the North, West, and Maverick Street Outfalls. These exceedances were reported during April and November of 2010, respectively, as required.
- Massport's Stormwater Pollution Prevention Program (SWPPP) addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants. The 2010 Annual Certificates of Compliance were submitted to the U.S. Environmental Protection Agency (EPA) and MassDEP on December 21, 2010, for Massport and each tenant co-permittee.

Massport has several significant landside projects underway. The Southwest Service Area Redevelopment Project and the Green Bus Depot Project in the North Service Area are both covered under EPA NPDES **B-16** Construction General Permits (CGP) and associated Stormwater Pollution Prevention Plans (SWPPP). The Water Quality Monitoring Requirement section of the EDR does not reference the CGP's or the project's SWPPP's. As there is no information provided on construction phase monitoring, the stormwater outfalls serving the construction areas should be monitored weekly for typical constituents of construction site runoff, such as total suspended solids, pH, oil and grease. Area catch basins, stormwater infrastructure, erosion and sediment control Best Management Practices and dewatering systems should also be monitored weekly.

The Water Quality Monitoring Requirements of the EDR notes that there are no NPDES limitations for the Northwest Outfall. NPDES discharge limitations should be established as a portion of the property is transitioning from a construction laydown area to a bus depot with a fueling station and below grade fueling tanks. The Northwest Drainage Area also has several parking areas and uses considered Land Uses with **B-17** Higher Potential Pollutant Loading, as defined under the State Stormwater Management Standards. More stringent NDPDES monitoring standards should be applied as with the North, West, Porter, and Maverick Street outfalls.

The Fuel Use and Spills in 2010 section indicates jet fuel spills accounted for the majority of fuel spilled by **B-18** volume. Massport may consider the installation of fuel spill response kits in locations with the greatest opportunity for spills to occur, such as where fuel is being transferred from tanks and fuel lines to vehicles and jets. It is not clear from the EDR if under the SWPPP the 27 co-permittees are trained in spill management and are required to have spill containment material available. In instances where fuel is spilled and enters a waterway or wetland resource area, the local Conservation Commission should be informed immediately as spills have the potential to impact and alter resource areas.

B-19 The EDR does not reference the Water Quality Study (WQS) required under Massport's NDPES permit. The intent of the WQS is to increase the understanding of discharges from the airport's outfalls, determine if violations are present and assist in establishing water quality based pollutant limits in the future. The WQS also requires real time monitoring of outfalls during deicing episodes to assist in determining if supplemental BMP's are necessary under the SWPPP to better protect water quality. A discussion of the WQS, monitoring results and changes to effluent standards should be included in future EDRs/ESPRs.

Sustainability at Logan Airport

Massport has a dedicated Sustainability Program Manager with responsibility to coordinate and fulfill its sustainability commitment across all lines of business. Massport's activities and include, but are not limited to:

- benchmarking;
- LEED Plus for new construction with a goal to achieve at least LEED Silver certification;
- purchase of low emission ground transportation vehicles;
- offer recycling in terminal areas;
- environmentally preferred purchasing;
- retrofit or purchase heavy-duty equipment with diesel oxidation catalysts or particulate filters;
- install at the new ConRAC facility the infrastructure necessary to accommodate future plug-in stations for electric vehicles and other alternative fuel sources such as E-85 (ethanol);

- install efficient water systems, including water reclamation for vehicle wash water and use of stormwater for non-potable uses such as vehicle washing and landscaping irrigation at ConRAC;
- use of solar panels and solar trees;
- use of warm mix asphalt; and
- single-stream recycling dumpsters for paper cardboard, plastic, aluminum, and glass.

This department understands the many challenges facing airlines and airport proprietors and is aware of the effort required to prepare EDRs/ESPS. At the same time, what will likely be one and one-half years between updates reduces the chance that comments will address and make a difference in areas of concern. We would support the proposal so long as a brief update, including a response to our comments prepared and circulated addressing the following: **B-20**

- TDM - passengers and employees;
- efforts to maximize the use of Hanscom;
- water quality/environmental compliance and management;
- noise complaint information; and
- project and mitigation status.

Climate Change and Adaptation

We ask that Massport include in an interim filing a discussion of the potential impacts of climate change on Logan and the ways in which it will approach adaptation. The next EDR/ESPR should include a Climate Change and Adaptation chapter. **B-21**

Thank you for the opportunity to comment and for your consideration.

Sincerely,

Maura T. Zlody
Senior Environmental Policy Analyst

Logan 2010 EDR, 12.11.doc:DBG/MTZ.mtz

Comment #	Author	Topic	Comment	Response
B.1	Boston Environment Department	MEPA	Massport has asked that the next filing, a 2011 Environmental Status and Planning Report (ESPR), be submitted to MEPA in Spring 2013. This department would support an extension for a full report should a response to comments and requested information be provided by Spring 2012.	Massport published advance information in October 2012 to provide reviewers with a preview of the data reported on in the *2011 Logan Airport Environmental Status and Planning Report (2011 ESPR).* It is available on the website: http://www.massport.com/environment/Pages/Default.aspx. Currently, a visitor to Massport's environmental website could find information on green initiatives at Massport facilities, Massport's achievements in environmental efforts, Massport's environmental management policy, environmental reporting, and related links.
B.2	Boston Environment Department	Regional Transportation	In numerous filings with MEPA, Massport has cited its work on the NERASP Study and has referenced it as the basis for conclusions. We have requested several times that Massport provide the report as an Appendix and be specific about findings and their basis when the study is cited. We reiterate this request.	The *New England Regional Airport System Plan (NERASP)* is publically available from the Federal Aviation Administration (FAA) at the following website: http://www.faa.gov/airports/new_england/planning_capacity/airport_system_plan/. *Chapter 2, Activity Levels,* of this *2011 ESPR* includes more detailed information regarding the NERASP.
B.3	Boston Environment Department	Mitigation	Massport identifies these commitments as implemented but there is no information in the EDR regarding the current status of employer participation in the TMA or the current status of the TMA and its members. Given the challenges the TMA has encountered and its importance in maximizing non-auto commuting, we believe that an update of the current situation and expected future of TMA membership and programs should be provided and that this Finding be considered Ongoing rather than Implemented.	The Logan Transportation Management Association (Logan TMA) is described in *Chapter 5, Ground Access to and from Logan Airport.* Massport continually evaluates its employee programs, including the Logan TMA, and makes adjustments as necessary to fit the needs of participants.
B.4	Boston Environment Department	Air Quality	We applaud Massport for engaging MIT in studies of single-engine taxiing and pushback rate control. We understand that Massport will continue to survey airlines periodically about single-engine taxiing. The status of pushback rate control is not discussed; we would welcome an update and discussion.	Additional information regarding single-engine taxiing and pushback rate control is provided in *Chapter 7, Air Quality/ Emissions Reduction.*

Comment #	Author	Topic	Comment	Response
B.5	Boston Environment Department	Regional Transportation	Table 4.3, Share of Scheduled Domestic Departures – Logan Airport and the Ten Regional Airports, show Logan's numbers from 2005-2010 then group other airports – cumulative numbers are reported for Bradley, Manchester-Boston and T.F. Green with another set of cumulative numbers for Bangor, Burlington, Hanscom, Portland, Portsmouth, Tweed-New Haven and Worcester. There is no explanation for reporting cumulative data. Given their individual roles in regional transportation, data for each airport should be reported individually.	Cumulative totals were shown in Table 4-3 to simplify the data presentation in *Chapter 4, Regional Transportation,* of the *2010 Environmental Data Report (EDR)* . One cumulative total was shown for the largest of the regional airports (Bradley, Manchester-Boston, and T.F. Green) and a second cumulative total was shown for the remaining airports to show that large and small secondary airports have experienced a reduction in scheduled airline services. Data for each airport is presented individually in Appendix F. In the *2011 ESPR,* cumulative information is provided in *Chapter 4, Regional Transportation,* and individually in Appendix F.
B.6	Boston Environment Department	Regional Transportation	As we have previously requested, Massport should provide information in EDRs/ESPRs about the goals of each planning effort, the specific activities of each [cooperative metropolitan planning efforts] and details about the role that Massport has played in each.	The *2011 ESPR* describes Massport collaboration with other regional transportation organizations in planning for the region's transportation needs. See *Chapter 4, Regional Transportation.*
B.7	Boston Environment Department	Regional Transportation	Information on operations by Streamline and Linear Air should be provided, now and in EDRs/ESPRs, as should a description of Massport's efforts attract and retain niche commercial service at Hanscom.	A description of the role Hanscom Field, including activity levels, is provided in *Chapter 4, Regional Transportation.* Massport's efforts at Hanscom Field are the subject of a separate ESPR, the preparation of which is currently underway. The Boston Environment Department will be included in the Hanscom ESPR distribution.
B.8	Boston Environment Department	Ground Access	The increases in Logan Express use are less than half of the increase in passengers. We would appreciate Massport's perspective about the 2010 use levels in relation to passenger level increases.	Massport continuously monitors Logan Express ridership activity, and in response has recently made service and pricing changes in an attempt to capture more of the air passenger ground-access market. As detailed in *Chapter 5, Ground Access to and from Logan Airport,* Massport extended late night Logan Express service hours from Logan and added to its early morning service. In March 2012, Massport lowered the parking rate at the Logan Express sites. These changes have resulted in increased Logan Express passenger activity at rates higher than the changes in Logan Airport air passengers. Further enhancements are under consideration. Massport introduced a marketing/media campaign in the spring of 2012, to promote the use of Logan Express and public transit to Logan Airport. Further pricing incentives will be considered during peak periods.

Comment #	Author	Topic	Comment	Response
B.9	Boston Environment Department	Ground Access	We ask that Massport explain the information and conclusion reached regarding limousine ridership. What is the method for estimating ridership (16 percent increase in 2010) and how was the conclusion reached that the 2010 Survey data revealed no increase in relative share?	The method for estimating limousine ridership is based on the average passengers per vehicle, as determined from the 2010 survey responses, and the actual number of dispatched limos from the bus/limousine pool.
B.10	Boston Environment Department	Ground Access	This department has requested several times that the [2010 Logan Airport Air Passenger Survey] used by Massport be provided in the appropriate EDR or ESPR subsequent to its administration and that the response rate be provided. We ask that this be provided in interim information and in future filings with MEPA.	The *2010 EDR* featured the key results of the ground-access survey, as well the background, overview, and survey method. The results of the planned 2013 survey will similarly be included in the *2012/2013 EDR*. For more details and complete information about the survey, including the method, response rates, survey questionnaire, and additional results, please refer to its final report. A copy of 2010 survey final report and questionnaire are available on the Massport website under the Environmental Reporting section; once completed, the 2013 report will be available via the website, as well.
B.11	Boston Environment Department	Ground Access	We request that Massport provide information on the marketing and utilization rate of [the preferred parking program] spaces.	Massport offers guaranteed parking through its Parking PASSport Gold program. About 8 percent of spaces in the Central/West Parking garage and 12 percent of spaces in the Terminal B garage are set aside for these customers. On Tuesdays and Wednesdays (the peak occupancy days), these designated areas are filled close to capacity in approximately 30 to 35 weeks a year. In terms of marketing, Massport has not had an active, targeted marketing program in place for PASSport Gold since 2010. The program is now branded Lexus Parking PASSport Gold, and airport customers are exposed to the product through signs that are visible in many areas of the airport and via the Logan Airport website.
B.12	Boston Environment Department	Ground Access	While minimizing the time it takes for motorists to find a parking space is good for local air quality, [the Parking PASSport Gold Program] may encourage air passengers to drive to Logan so it is not a measure designed to encourage HOV use.	This program is one element of Massport's overall parking program and it appeals to a small segment of those who park with regularity. PASSport Gold customers are unlikely candidates for high occupancy vehicles (HOV)/shared-ride services. Most of these customers are regular fliers and frequent parkers, often traveling on business, and aren't passengers that formerly used (or would use) a HOV/shared-ride mode for their trip to the airport. PASSport Gold customers make up approximately 3 to 4 percent of parking activity at Logan Airport. Additional information is provided in *Chapter 5, Ground Access to and from Logan Airport.*

Comment #	Author	Topic	Comment	Response
B.13	Boston Environment Department	Mitigation	As stated earlier in these comments, we believe that the current and expected future situations with TMA membership and programs should be provided and that this Finding be considered Ongoing rather than Implemented.	The Logan TMA is described in *Chapter 5, Ground Access to and from Logan Airport.* Massport continually evaluates its employee programs, including the Logan TMA, and makes adjustments as necessary to fit the needs of participants.
B.14	Boston Environment Department	Noise	This department receives phone calls from residents of East Boston who participated in the early sound insulation/room-of-choice program and finding that windows have reached their useful life, some because of the effects of vibration, and are no longer providing the original level of benefit. It may be that a limited lifespan was not a subject of consideration when the program was implemented. We ask that Massport discuss this issue.	Massport was one of the first airports to provide sound insulation to affected residents. Massport has reached out to the FAA regarding the long-term effectiveness of the original technology. The FAA has not funded similar re-insulation of homes which were previously sound insulated with the original technologies. This is reflected in the FAA's August 17, 2012 Program Guidance Letter 12-09 which confirms that previously insulated homes are ineligible for sound insulation funding and that ongoing maintenance and replacement of sound insulating measures are residents' responsibility. To review the Program Guidance Letter, please visit: http://www.faa.gov/airports/aip/guidance_letters/ Massport is involved in assessing the ongoing benefits of the original technologies used for sound insulation. In conjunction with others, Massport submitted a problem statement to the Airport Cooperative Research Program (ACRP) regarding the long-term effectiveness of sound insulation programs including design criteria, materials, and installation standards. The problem statement was accepted, and is currently active in research. For more information on this ACRP research project, please visit: http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3032.
B.15	Boston Environment Department	Noise	ESPRs/EDRs include no information about noise complaints other than their numbers and the neighborhood or municipality of the complainants. It would be useful to know how complaints break down on these parameters: arrival or departure; month; day of week; time of day; runway; type of aircraft; and the determination of aircraft compliance with prescribed flight tracks.	In the Logan EDRs and ESPRs, Massport provides the noise complaint information as one of many sources of data that together provide an understanding of airport noise and its affects within the adjacent communities. In addition to noise compliant information, Massport provides runway use, noise monitoring results, Day-Night Sound Level (DNL), and cumulative noise index (CNI) to provide a complete picture of the airport noise environment. Specific information on noise complaints and their sources can be provided upon request by contacting the Noise Office at 617-561-3333.

Comment #	Author	Topic	Comment	Response
B.16	Boston Environment Department	Water Quality	The Water Quality Monitoring Requirement section of the EDR does not reference the CGP's or the project's SWPPP's. As there is no information provided on construction phase monitoring, the stormwater outfalls serving the construction areas should be monitored weekly for typical constituents of construction site runoff, such as total suspended solids, pH, oil and grease. Area catch basins, stormwater infrastructure, erosion and sediment control Best Management Practices and dewatering systems should also be monitored weekly.	Massport requires all of their contractors to monitor construction sites for erosion and sedimentation pathways to the stormwater outfalls and correct any breaches or issues on a regular basis. *Chapter 8, Water Quality/Environmental Compliance and Management,* describes additional measures which were undertaken at Logan Airport construction sites following exceedances in the monitoring reports submitted to the Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP).
B.17	Boston Environment Department	Water Quality	More stringent NPDES monitoring standards should be applied as with the North, West, Porter, and Maverick Street outfalls.	Massport adheres to the monitoring requirements of the EPA that are conditions of the existing National Pollution Discharge Elimination System (NPDES) permit. Monitoring reports and exceedances are reported to the EPA and MassDEP within the time periods dictated in the permit. Additional information is provided in *Chapter 8, Water Quality/Environmental Compliance and Management,* and *Appendix J* . Reports are also posted on Massport's website.
B.18	Boston Environment Department	Water Quality	Massport may consider the installation of fuel spill response kits in locations with the greatest opportunity for spills to occur, such as where fuel is being transferred from tanks and fuel lines to vehicles and jets. It is not clear from the EDR if under the SWPPP the 27 co-permittees are trained in spill management and are required to have spill containment material available. In instances where fuel is spilled and enters a waterway or wetland resource area, the local Conservation Commission should be informed immediately as spills have the potential to impact and alter resource areas.	Massport staff and the co-permittees follow the training, prevention, monitoring, and reporting requirements of the Massachusetts Contingency Plan (MCP).
B.19	Boston Environment Department	Water Quality	The EDR does not reference the Water Quality Study (WQS) required under Massport's NDPES permit. The intent of the WQS is to increase the understanding of discharges from the airport's outfalls, determine if violations are present and assist in establishing water quality based pollutant limits in the future. The WQS also requires real time monitoring of outfalls during deicing episodes to assist in determining if supplemental BMP's are necessary under the SWPPP to better protect water quality. A discussion of the WQS, monitoring results and changes to effluent standards should be included in future EDRs/ESPRs.	The Water Quality Study (WQS) was required under the 2007 permit pursuant to Part 1.D (page 49-50 of 51). The study was completed and the report was transmitted to EPA and the DEP in September 2009. There is no ongoing requirement to continue the WQS. The 2009 Boston-Logan Water Quality Study found that deicer use at Logan Airport did not have a material environmental impact on Boston Harbor. Massport continues to monitoring effluent pursuant to permit requirements, and Massport and its co-permittees continue to implement the applicable best management practices (BMPs) pursuant to the Stormwater Pollution Prevention Plan (SWPPPs).

Comment #	Author	Topic	Comment	Response
B.20	Boston Environment Department	MEPA	We would support the proposal [to submit the ESPR in Spring 2013] so long as a brief update, including a response to our comments prepared and circulated addressing the following: TDM - passengers and employees; efforts to maximize the use of Hanscom; water quality/environmental compliance and management; noise compliant information; and project mitigation status.	Please see the response to Comment B.1.
B.21	Boston Environment Department	Sustainability	We ask that Massport include in an interim filing a discussion of the potential impacts of climate change on Logan and the ways in which it will approach adaptation. The next EDR/ESPR should include a Climate Change and Adaptation chapter.	Massport has actively participated in the state's effort on climate change adaptation planning. In September 2011, the Executive Office of Energy and Environmental Affairs, issued a report that documents state-wide efforts: http://www.mass.gov/eea/docs/eea/energy/cca/eea-climate-adaptation-report.pdf. Massport has included additional information on adaptation for climate change in recent filings. Climate change is being reviewed as part of a broad airport-wide overview. The next EDR will report on any new information that is generated by this study.

BOSTON
TRANSPORTATION
DEPARTMENT

ONE CITY HALL PLAZA • ROOM 721
BOSTON, MASSACHUSETTS 02201
617-635-4680 • FAX 617-635-4295

December 7, 2011

RECEIVED
DEC 15 2011
MEPA

The Honorable Richard K. Sullivan, Jr., Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, Massachusetts 02114

Re: Logan Airport 2010 Environmental Data Report (2010 EDR) – EOEA # 3247

Dear Secretary Sullivan:

The Boston Transportation Department has reviewed the above document and is pleased to submit the following comments for your review.

Activity Levels

BTD is once again pleased to see how the number of flights has increased minimally while the number of passengers using Logan has increased substantially. Since 2005, the average load factor at Logan has increased from 66.2 passengers per flight in 2005 to 77.8 passengers per flight in 2010. This airline trend continues in 2011. While Massport has minimal input regarding this issue, it is important from a noise abatement perspective, since if the load factor remains constant and passenger levels increase, obviously it would require more flights to accommodate future demand. We are also pleased to see how the number of cargo flights at Logan has decreased 4.74% from 2009 to 2010.

Southwest Service Area Redevelopment Program

C-1 BTD supported the downsizing of the CONRAC Project. The elimination of commercial parking from the project will decrease environmental impacts in the nearby neighborhood. Also, we believe the new and improved design of the structure will also contribute environmental benefits. However, it must be stated that Massport must work with the car rental companies upon completion of the project to ensure environmental impacts are kept to minimum. C-2 Since this type of airport operation operates twenty-four seven, strict controls must be set in place to protect residents living in the abutting homes. BTD would like to suggest that Massport develop a hot line that residents could call in case of any disturbances that may occur during the evening or early morning hours.

THOMAS M. MENINO, Mayor

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Logan Runway Safety Area Improvements Project at Runways 33L & 22R (RSA)

The RSA for Runway 33L is near completion and during construction Logan became primarily a north/south airport. While this is understood because 33L had to be closed while work was going on, Massport should be more informative with communities that will experience a substantial increase in noise levels due to the construction. Whenever a runway is closed over a long period of time, Massport must be aware of the shift in impacts that coincide with the project. **C-3**

The construction of the RSA for Runway 22R should commence soon and BTD is hopeful that Massport will be more informative with the communities that could experience an increase in over-flights and therefore more noise. **C-4**

Also, many residents living in the Orient Heights neighborhood located directly behind the approach end of 22R are fearful that the new RSA could change the operation criteria currently governing approaches to 22R.

Over the last several years, the level of large commercial jets landing on 22R has increased dramatically. Currently, under Massport's own noise rules, arrivals on 22R are limited to aircraft with a maximum certified noise level of 78 DBA. Arrivals on 22R are prohibited from 11:00 PM to 6:00 AM. Since the removal of the Blast Fence on the approach end of 22R, the numbers of large aircraft exceeding this noise level have landed on 22R which has had a dramatic effect on the residents of Orient Heights. Massport must be more diligent in developing a dialogue with the FAA to make it clear this procedure in unacceptable from both a community and City of Boston perspective. BTD sincerely hopes this issue will be taken more seriously than in the past, residents of the Orient Heights neighborhood suffer enough with impacts from other operations, they should not be expected to suffer any more than they have to. **C-5**

In closing, BTD looks forward to be working with Massport on future developments with the hope of accommodating airport growth without inflicting additional impacts on neighboring residents.

Sincerely,

Robert D'Amico
Senior Planner

BOSTON TRANSPORTATION DEPARTMENT
ONE CITY HALL PLAZA/ROOM 721, BOSTON, MA 02201 • (617) 635-4680

Comment #	Author	Topic	Comment	Response
C.1	Boston Transportation Department	Airport Planning	BTD supported the downsizing of the CONRAC Project. The elimination of commercial parking from the project will decrease environmental impacts in the nearby neighborhood. Also, we believe the new and improved design of the structure will also contribute environmental benefits. However, it must be stated that Massport must work with the car rental companies upon completion of the project to ensure environmental impacts are kept to minimum.	The consolidated rental car (ConRAC) project is in itself a mitigation project that takes vehicles off the roadway system. In addition, a comprehensive series of operational measures will be deployed to reduce energy consumption, improve air quality, and reduce impacts to the surrounding neighborhood. Massport and the car rental companies are working cooperatively to prevent environmental impacts, such as air quality and noise effects, from occurring at the ConRAC facility. Further, once completed and fully operational, the ConRAC, Green Bus Depot, East Boston-Chelsea Bypass Road, and the Logan Airport Economy Parking Garage are expected to yield substantial environmental benefits, particularly in the areas of ground access efficiencies and associated air quality emissions reductions on-Airport and in East Boston. Refer to *Chapter 3, Airport Planning,* and *Chapter 9, Project Mitigation Tracking.*
C.2	Boston Transportation Department	Airport Planning	Since this type of airport operation operates twenty-four seven, strict controls must be set in place to protect residents living in the abutting homes. BTD would like to suggest that Massport develop a hot line that residents could call in case of any disturbances that may occur during the evening or early morning hours.	Neighbors of Logan Airport may contact the Airport with any concern regarding disturbances during the evening or early morning hours. Massport will evaluate the usefulness of a ConRAC hotline and implement if needed.
C.3	Boston Transportation Department	Noise	The RSA for Runway 33L is near completion and during construction Logan became primarily a north/south airport. While this is understood because 33L had to be closed while work was going on, Massport should be more informative with communities that will experience a substantial increase in noise levels due to the construction.	Prior to and during the Runway 33L construction, Massport completed outreach to the community regarding the runway closure. Outreach included notices in the local newspapers, community briefings, mailings to the Community Advisory Committee (CAC), and ongoing status briefings to the CAC.
C.4	Boston Transportation Department	Noise	The construction of the RSA for Runway 22R should commence soon and BTD is hopeful that Massport will be more informative with the communities that could experience an increase in over-flights and therefore more noise.	Construction of Runway 22R is not scheduled to begin until 2014. Massport will continue to make information available on potential noise and air traffic changes during construction, consistent with the informative approach used for the Runway 33L Runway Safety Area (RSA) construction project.

Comment #	Author	Topic	Comment	Response
C.5	Boston Transportation Department	Noise	Over the last several years, the level of large commercial jets landing on 22R has increased dramatically. Currently, under Massport's own noise rules, arrivals on 22R are limited to aircraft with a maximum certified noise level of 78 DBA. Arrivals on 22R are prohibited from 11:00 PM to 6:00AM. Since the removal of the Blast Fence on the approach end of 22R, the numbers of large aircraft exceeding this noise level have landed on 22R which has had a dramatic effect on the residents of Orient Heights. Massport must be more diligent in developing a dialogue with the FAA to make it clear this procedure in unacceptable from both a community and City of Boston perspective.	Massport is tracking this runway noise mitigation for Runway 22R arrivals and Runway 4L departures and sharing the information with the City of Boston and the FAA on a regular basis. For example, in 2011 there were eight jet arrivals on Runway 22R (out of an airport total of about 175,000 arrivals that year). There were no Runway 4L jet departures in 2011.

CITY OF CAMBRIDGE • EXECUTIVE DEPARTMENT

Robert W. Healy, City Manager *Richard C. Rossi, Deputy City Manager*

RECEIVED

DEC 09 2011

MEPA

December 8, 2011

Richard K. Sullivan, Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Re: EOEA #3247 Logan Airport 2010 EDR

Dear Secretary Sullivan:

The City of Cambridge is pleased to have the opportunity to submit comments on Massport's 2010 Logan Environmental Data Report (EDR).

D-1 The City of Cambridge continues to be greatly concerned about the continued, increased use of runway 33L which increased for both arrivals and departures in 2010. These increases began in 2007, continued in 2008 and 2009, and have resulted in significantly higher levels of noise and disturbance in all parts of the City. While departures on 33L rose 1%, arrivals rose by 5%, a very significant increase. This makes a combined 33% of Logan trips which now use 33L, more than the most recent high of 2007 at 30% and higher than anytime that the City is aware of. In the Secretary's certificate of Nov. 12, 2010, MassPort was directed to address the City of Cambridge's concerns and suggestions related to noise in this year's EDR and have failed to do so. I would therefore request that the Secretary deny a certificate for this EDR until MassPort has adequately fulfilled this directive.

D-2 Also pointed out in the City's comments of last year is the increase in low flying flights over the central and northern parts of the city. This continues to be a source of noise and disturbance for many in the City and should be addressed by MassPort and FAA. This may be partially related to flight tracks for non-jet departures shown in Figure 6-10, which shows significant activity over Cambridge.

In terms of ground transportation, Cambridge shares the Secretary's concern raised in last year's certificate related to increases in demand for parking at Logan which have not been D-3 addressed in this EDR. MassPort should commit to firm goals related to mode splits for ground transportation and should consider reducing parking supply or other transportation demand management tools if goals are not achieved. This idea of setting benchmarks and goals is something that MassPort should consider for all of its environmental programs. As a D-4 first step, MassPort should commit to complying with the Massachusetts Clean Energy and

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Climate Plan for 2020, although it is not one of the state agencies which has already committed to this plan.

D-4 con't.

I appreciate the MEPA office's consideration of these concerns and look forward to your efforts to address them. Please feel free to contact Bill Deignan at 617-349-4632 if you have any questions in regard to these comments.

Very truly yours,

Robert W. Healy

Robert W. Healy
City Manager

Comment #	Author	Topic	Comment	Response
D.1	City of Cambridge	Activity Levels	The City of Cambridge continues to be greatly concerned about the continued, increased use of runway 33L which increased for both arrivals and departures in 2010.	The FAA (air traffic) assigns runway usage based on existing aircraft traffic and meteorological conditions. The increased use of Runway 33L during 2010 was due to air traffic, ground traffic, and weather conditions. *Chapter 6, Noise Abatement,* documents runway usage in 2010 and 2011. As part of the ongoing Boston Logan Airport Noise Study (BLANS), alternative flight track and runway use options are being evaluated.
D.2	City of Cambridge	Noise	Also pointed out in the City's comments of last year is the increase in low flying flights over the central and northern parts of the city. This continues to be a source of noise and disturbance for many in the City and should be addressed by Massport and FAA.	As in previous years, there are annual variations in runway use due to seasonal variation in wind and weather patterns, operational fleet mix, and FAA day to day operational decision making. This corridor is being reviewed as part of the BLANS.
D.3	City of Cambridge	Ground Access	Massport should commit to firm goals related to mode splits for ground transportation and should consider reducing parking supply or other transportation demand management tools if goals are not achieved.	Massport has a long-established HOV mode share goal of 35.2 percent at a 37.5 million air passenger level. Parking pricing, ground access services, and related policies, are all established with this goal in mind. For more detail about the goal and on the ways Massport encourages the use of alternative travel modes for airport access by passengers and employees, please refer to *Chapter 5, Ground Access to and from Logan Airport.*
D.4	City of Cambridge	Sustainability	As a first step, Massport should commit to complying with the Massachusetts Clean Energy and Climate Plan for 2020, although it is not one of the state agencies which has already committed to this plan.	Massport implements a number of sustainability elements in individual projects as well as the overall operation of Logan Airport. Refer to *Chapter 1, Introduction/Executive Summary,* for more information. In 2010, Massport voluntarily committed to the Governor's "Leading by Example" Initiative and its efficiency, renewable and greenhouse gas reduction objectives for 2012 and 2020. However, Massport has not committed to complying with the Massachusetts Clean Energy and Climate Plan for 2020.

14 December 2011

Secretary Richard K. Sullivan, Jr.
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114
ATT: MEPA Office

RE: EOEA #3247- 2010
Environmental Data Report
Boston-Logan International Airport, Boston

Dear Secretary Sullivan:

The Boston Harbor Association, a non-profit, public interest organization founded in 1973 by the League of Women Voters and the Boston Shipping Association to promote a clean, alive, and accessible Boston Harbor, is in receipt of the 2010 Environmental Data Report for Boston-Logan International Airport, Boston. An environmental data report has been required annually since 1989 to discuss the cumulative environmental effects of Logan Airport's operations and activities.

As noted by the Massachusetts Port Authority, owner and operator of Logan Airport, improvements in a number of environmental areas were observed in 2010, with airlines operating more efficiently with more passengers per aircraft and cleaner and quieter planes. At the same time, due to continued global economic conditions, the number of passengers were considerably lower than the all-time peak of 28.1 million passengers in 2007, thereby having less ground-access impacts.

We have reviewed the 2010 Environmental Data Report, and our comments follow:

<u>Cumulative Impacts of Massport Projects:</u> In 2010, Massport filed environmental permits for a number of large-scale projects, including a.) Southwest Service Area Redevelopment Program to construct a new consolidated rental car facility; b.) Logan Airport Green Bus Depot; and c.) Boston-Logan International Airport Runway Safety Area Improvements Project. TBHA submitted detailed comment letters on these projects in 2010 as well as during the earlier permitting cycles of these projects. The first two projects are designed to replace and upgrade existing ground transportation uses and facilities, incorporate site improvements including roadway modifications and pedestrian and bicycle facilities, and to provide a consolidated facility for airport shuttle buses. The third project is designed to enhance the safety area at the ends of Runway 33L and Runway 22R.

E-1

Documents for the environmental permitting of each of these very large, multi-million dollar projects appear to only evaluate individual project impacts, and do not appear to consider cumulative impacts during overlapping construction periods nor any cumulative permanent impacts. We ask that the Environmental Status and Planning Report (ESPR) for 2011 be filed no later than March, 2013, and that the ESPR evaluate the cumulative environmental impacts of these and other on-going projects. We also ask that the ESPR provide an update on the completion status of the environmental mitigation measures vis a vis the completion of the related project, e.g., successful restoration or re-establishment of eelgrass at the ratio specified in the Secretary's Certificate and on a completion schedule consistent with the

E-2

E-2 con't. completion of the Boston-Logan International Airport Runway Safety Area Improvements Project.

Water Quality Impacts: The stormwater permit for the airport requires monthly grab samples from four outfalls. The Environmental Data Report notes that a few samples at Maverick Street Outfall and North Outfall exceeded permitted standards for total suspended solids. To address the April 2010 TSS exceedance at Maverick Street outfall, Massport inspected and cleaned the catch basins and manholes within the drainage areas. Massport is also requiring tenants located within the Maverick Street Outfall drainage area to conduct inspections and to clean out structures and replace filter inserts.

Regarding the tracking of bacteria sources, Massport is implementing a Stormwater Pollution Prevention Plan to investigate potential sources of bacteria, including the presence of animal waste such as bird waste. Last fall, Massport had a contractor collect stormwater samples to identify potential bird markers, human markers, and fluorescent whitening agents. Massport proposes to report the results of the lab

E-3 analyses in the 2011 ESPR. While we believe it appropriate to include the detailed lab analyses in the 2011 ESPR to be completed by March, 2013, we suggest more immediate action in 2012 in the event of significant bacteria levels in the stormwater runoff.

Last winter, Massport requested permission to lift the ban on snow dumping into Boston Harbor because of significant snow amounts. We concur with Boston Mayor Thomas M. Menino that this would have been a

E-4 unfortunate precedent, suggesting that, for cost reasons, quasi-public entities should be allowed to put potentially pollutant-laden and/or chemical-laden snow into Boston Harbor. We strongly request that the project proponent not attempt to seek such an exemption again, and we further request that if the agency petitions to have the ban on snow dumping lifted, city, state, and federal regulators should not approve it.

Open Spaces: Although not a traditional park/open space agency, Massport does an exceptional job of maintaining its public open spaces and parks, including those near Logan Airport. Bremen Street Park, next to Airport station on the MBTA Blue Line, is patrolled and well-maintained, and its playground area, spray fountain, and sitting areas were greatly enjoyed by thousands of local residents and their children in 2010. Navy Fuel Pier, an airport buffer area, is another well-designed, popular viewing area along Boston Harbor. Piers Park is considered by many to be a beautiful jewel along Boston Harbor, and continues to

E-5 be both well-maintained and much-used by the local community. We ask that diligent, consistent maintenance continue at all of the airport-related and adjacent open spaces, buffer areas, and parks.

Table 3-5 of the 2010 EDR (page 3-19) noted the selection of a design consultant for the North Service Area Buffer/Neptune Road Buffer in May 2009. The narrative notes, however, that the community planning process did not begin until December, 2010. This segment is a key connection to the much-anticipated East Boston Greenway Extension project agreed to during Boston Conservation Commission deliberations

E-6 on the Green Bus Depot project. We ask that additional information be provided regarding why there was an 18-month delay between selection of a design consultant and commencement of the community planning process in 2010, and how such a delay will be avoided in the community planning process for the East Boston Greenway Extension of the Green Bus Depot project.

In agreeing to support the delay of the filing of the 2011 Logan Airport ESPR until March, 2013 (rather

than the more traditional deadline of September, 2012), TBHA requests that an update on completion of the East Boston Greenway Extension, consistent with the completion date of the Green Bus Depot, be provided no later than September, 2012. **E-7**

HarborWalk Amenities: As part of the Southwest Service Area Redevelopment Project, the existing taxi pool located adjacent to the rental car facilities on Harborside Drive will be relocated. The taxi pool relocation will include the construction of a 3,500 square foot, single story building with rest room facilities for cab drivers. At the end of the four year construction period of the consolidated rental car facility, the taxi pool will then move back.

During the February, 2010 hearing by the Boston Conservation Commission on the taxi pool temporary relocation, the Conservation Commissioners asked about the post-four year usage of the single story building. Massport had not decided what, if any, use there would be for the building, and the Conservation Commission's Order of Conditions requested consideration of the building for a public use. Given the proximity of the building to Boston Harbor and to the HarborWalk near the Hyatt Harborside Hotel, we request additional information on the future public use of the building, particularly for educational exhibits, public information, or bicycle repair, rental, or storage, and to make the public rest rooms in the building available for use by the general public when the taxi pool is relocated. **E-8**

Environmental Sustainability: Massport prides itself on its environmental sustainability initiatives at Logan Airport, including a clean-fuel shuttle bus fleet operated within the airport, LEED Plus standards, energy-efficient operations, and a goal of zero use of potable water for irrigation. The Boston Harbor Association commends Massport for implementation of these measures.

The Boston Harbor Association further applauds Massport's stated commitment of supplementing its overall electricity use with renewable energy, including most recently with solar energy at Terminal B Garage, the Economy Garage, and Terminal A, and with micro-wind turbines on top of the Logan Office Center. We understand, though, that this constitutes less than 10% of total energy usage, and urge implementation of a more aggressive, less timid incorporation of renewable energy at Logan Airport. **E-9** By contrast, the Massachusetts Water Resources Authority is implementing a number of on-going and new renewable energy programs to ensure that its Deer Island facility achieves 30% renewable energy usage by 2020, consistent with Governor Deval Patrick's Executive Order 484.

Climate Change and Sea-Level Rise: In November, 2010, The Boston Harbor Association sponsored a two-day, first-ever "Boston Harbor Sea-Level Rise Forum." Tom Kinton, Executive Director of Massport, spoke eloquently about the need for the airport and other Massport facilities to be aware of the impacts of potential sea-level rise over the next 50-75 years. Mention was made of the fact that the Green Bus Depot facility, which is in a higher risk area for sea-level rise, was modified in several ways to elevate key infrastructure above future flood elevations.

Consistent with the planning for the Green Bus Depot, we ask that all EDR and all ESPR filings indicate how potential sea-level rise has been incorporated into the planning of new facilities. We urge that Massport take into account sea level rise over the life of its projects, and if necessary, to elevate building foundations to take into account possible changes in sea level. **E-10**

Regarding climate mitigation, we urge Massport to continue its efforts to incorporate green/cool roofs into **E-11**

E-11 con't. its projects, as well as to provide additional plantings, vegetation, and trees in its projects, consistent with Mayor Menino's climate action plan to have 100,000 new trees planted in Boston by 2020.

E-12 Miscellaneous: Please correct Table D-2, Distribution List, for the 2010 EDR as well as all future ESPR/EDR to include The Boston Harbor Association. We have been a consistent commenter on these documents, and wish to be kept on the distribution list.

Thank you for your consideration.

Sincerely,

Vivien Li
President
The Boston Harbor Association

Comment #	Author	Topic	Comment	Response
E.1	The Boston Harbor Association	Airport Planning	Documents for the environmental permitting of each of these very large, multi-million dollar projects appear to only evaluate individual project impacts, and do not appear to consider cumulative impacts during overlapping construction periods nor any cumulative permanent impacts. We ask that the Environmental Status and Planning Report (ESPR) for 2011 be filed no later than March, 2013, and that the ESPR evaluate the cumulative environmental impacts of these and other on-going projects.	An ESPR's primary purpose is to consider the cumulative impacts of airport operations, including new projects, through assessing the noise, air quality, ground access and water quality impacts each year and compare them to previous years. In addition, the *2011 ESPR* considers the cumulative effects of future airport operations in 2030 through assessing impacts associated with forecast increased passenger activity levels and aircraft operations. In addition, each completed and proposed project is described in *Chapter 3, Airport Planning* , and individual projects are also assessed in appropriate environmental filings. The *2011 ESPR* is being filed by Spring 2013.
E.2	The Boston Harbor Association	Mitigation	We also ask that the ESPR provide an update on the completion status of the environmental mitigation measures vis a vis the completion of the related project, e.g., successful restoration or re-establishment of eelgrass at the ratio specified in the Secretary's Certificate and on a completion schedule consistent with the completion of the Boston-Logan International Airport Runway Safety Area Improvements Project.	*Chapter 9, Project Mitigation Tracking,* provides descriptions of the status of ongoing projects at the airport as well as the status of the mitigation associated with those projects.
E.3	The Boston Harbor Association	Water Quality	While we believe it appropriate to include the detailed lab analyses in the 2011 ESPR to be completed by March, 2013, we suggest more immediate action in 2012 in the event of significant bacteria levels in the stormwater runoff.	As described in *Chapter 8, Water Quality/Environmental Compliance and Management,* the bacteria levels in stormwater runoff were not significant. Additional analysis is ongoing.
E.4	The Boston Harbor Association	Water Quality	We strongly request that the project proponent not attempt to seek [a snow dumping] exemption again, and we further request that if the agency petitions to have the ban on snow dumping lifted, city, state, and federal regulators should not approve it.	Massport is charged with the safe operation of Logan Airport. During the winter of 2010-2011, a large amount of snow accumulated and had to be removed from the airfield to ensure safe operation of the airport. Massport worked with the city, state, and federal regulators to develop a solution for the snow removal, and would cooperatively work with those regulators in the future should a large amount of snow need to be removed from the airfield to ensure continued safe operation of the airport.
E.5	The Boston Harbor Association	Airport Planning	We ask that diligent, consistent maintenance continue at all of the airport-related and adjacent open spaces, buffer areas, and parks.	Massport continues to apply operations and maintenance guidelines to all of the airport-related and adjacent open spaces, buffer areas, and parks under its jurisdiction.

Comment #	Author	Topic	Comment	Response
E.6	The Boston Harbor Association	Airport Planning	We ask that additional information be provided regarding why there was an 18-month delay between selection of a design consultant and commencement of the community planning process in 2010 [for the North Service Area/Neptune Road Buffer], and how such a delay will be avoided in the community planning process for the East Boston Greenway Extension of the Green Bus Depot project.	The Greenway Connector is on track with construction documents being finalized in 2012. Construction is scheduled to begin in the spring of 2013.
E.7	The Boston Harbor Association	Airport Planning	In agreeing to support the delay of the filing of the 2011 Logan Airport ESPR until March, 2013 (rather than the more traditional deadline of September, 2012), TBHA requests that an update on completion of the East Boston Greenway Extension, consistent with the completion date of the Green Bus Depot, be provided no later than September, 2012.	As described in *Chapter 3, Airport Planning,* the Green Bus Depot has been completed. Construction of the Greenway Connector, also described in *Chapter 3, Airport Planning,* will begin in early 2013. Please see the response to Comment E.6.
E.8	The Boston Harbor Association	Airport Planning	Given the proximity of the [single-story] building to Boston Harbor and to the HarborWalk near the Hyatt Harborside Hotel, we request additional information on the future public use of the building, particularly for educational exhibits, public information, or bicycle repair, rental, or storage, and to make the public rest rooms in the building available for use by the general public when the taxi pool is relocated.	There are no current plans for re-use of this building at this time.
E.9	The Boston Harbor Association	Sustainability	We understand, though, that [supplementing overall electricity use with renewable energy] constitutes less than 10% of total energy usage, and urge implementation of a more aggressive, less timid incorporation of renewable energy at Logan Airport.	In July of 2008, Massport began creating the Utility Master Plan for all Massport properties specifically to forecast utility load requirements, develop energy efficiency and renewable action plans and provide ongoing monitoring and reporting. In 2010, Massport voluntarily committed to the Governor's "Lead by Example" Initiative and its efficiency, renewable and greenhouse gas reduction objectives for 2012 and 2020.
E.10	The Boston Harbor Association	Sustainability	Consistent with the planning for the Green Bus Depot, we ask that all EDR and all ESPR filings indicate how potential sea-level rise has been incorporated into the planning of new facilities. We urge that Massport take into account sea level rise over the life of its projects, and if necessary, to elevate building foundations to take into account possible changes in sea level.	Massport is in the process of reviewing this issue and will also look at this in relationship to all ongoing and future Massport projects.
E.11	The Boston Harbor Association	Sustainability	Regarding climate mitigation, we urge Massport to continue its efforts to incorporate green/cool roofs into its projects, as well as to provide additional plantings, vegetation, and trees in its projects, consistent with Mayor Menino's climate action plan to have 100,000 new trees planted in Boston by 2020.	Massport continues to incorporate sustainability elements, including green/cool roofs and landscaping, in their projects. For more information on sustainability efforts, refer to *Chapter 1, Introduction/Executive Summary.*

Comment #	Author	Topic	Comment	Response
E.12	The Boston Harbor Association	MEPA	Please correct Table D-2, Distribution List, for the 2010 EDR as well as all future ESPR/EDR to include The Boston Harbor Association. We have been a consistent commenter on these documents, and wish to be kept on the distribution list.	The Boston Harbor Association is included on the Distribution List in *Appendix D* .

AIR, Inc.
c/o Aaron Toffler
34 Kimball Street
Needham, MA 02492

December 9, 2011

Secretary Richard K. Sullivan, Jr.
Attn: Anne Canaday
Executive Office of Energy and Environmental Affairs, MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114-2524

Re: 2010 Environmental Data Report

Dear Ms. Canaday:

The following comments on the 2010 Logan Airport Environmental Data Report ("EDR") are being submitted on behalf of my client, Airport Impact Relief, Inc., a non-profit organization of East Boston and Winthrop residents:

1. Cumulative impact on Environmental Justice community:

   F-1 The 2010 EDR provides information on a great number of projects (East Boston/Chelsea bypass road, Logan Airport Parking Deck, NSA Roadway Corridor project, SWSA project, Logan Runway Safety Improvement project, Green Bus Depot) currently under construction on and around Massport's property. In the Certificate for the 2009 EDR, the Secretary specifically requires Massport to make assessment of the cumulative impacts of these projects a priority for the 2010 EDR.[1] In addition, because Logan Airport is located in an Environmental Justice community, such an analysis is required. However, such an analysis appears nowhere in the 2010 EDR. Massport should be required to undertake such an analysis and report the results not only to the State, but also directly to the community.

2. Enhanced outreach to Environmental Justice community:

   F-2 All of these projects are taking place in the context of an Environmental Justice community as identified by the Commonwealth of Massachusetts. As such, Massport is required to do enhanced outreach to the community so that all citizens that are impacted by the project have an opportunity to comment and participate in the public process. To date, that enhanced outreach has not occurred, either with respect to individual projects or this EDR. Massport needs to make the information in the EDR available to all of the residents of East Boston and Chelsea in appropriate media and language to ensure that the public has a right to comment on these projects. Massport's failure to do so thus far has resulted in a significant portion of the

[1] EDR Certificate, November 12, 2010 (EEA #3247).

community being left out of the public process in violation of the Commonwealth's Environmental Justice policy. F-2 con't.

3. Air quality and public health impacts.
The community herein reiterates its request that Massport fund a study of the impact on the adjoining community of ultra-fine particulate matter as a result of its operations. Such a study could be implemented by the Massachusetts Department of Public Health as part of its ongoing study (which Massport has agreed to support) or it could be incorporated as part of the current Logan Air Quality Monitoring Study. The adverse health impacts of ultra-fine particulate matter are being recognized across the country. Although, as Massport correctly states, there are currently no regulatory standards with respect to ultra-fine particulates, this is not a sufficient reason for not measuring them. A recent study of the Santa Monica Airport found that elevated exposure to ultra-fine particles associated with aircraft operations and jet takeoffs were found in the area of the airport and said exposure has dramatic health impacts on the adjacent community.[2] A similar study should be done to evaluate the impacts of ultra-fine particulate matter from Logan Airport's operations on the local community. Clearly such a study is required by Section 154 of Chapter 25 of the Acts of 2009 (the Transportation Reform Act).[3] Massport should be required to undertake such a study. F-3 F-4

Thank you for your attention to these matters. If you have any questions, please feel free to contact me at (617) 821-3497.

Very truly yours,

Aaron Toffler, Esq.

cc: Members of AIR, Inc.

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[2] That study can be found at: http://home.earthlink.net/~craap/sitebuildercontent/sitebuilderfiles/SMOHIA.pdf

[3] Section 154 of Chapter 25 of the Acts of 2009 reads "Notwithstanding any general or special law to the contrary, the bureau of environmental health within the department of public health shall conduct a comprehensive baseline study of the health effects of particulate air pollution from surface and air transportation. The study shall focus on understanding the health impacts from fine **and ultrafine particulate** matter upon populations that are located within 500 feet of any roadway with 50,000 or more motor vehicle trips per day, or any rail line regularly used by diesel locomotives or within 1 mile of any airport with more than 500 enplanements per week as reported between January 1, 2007 and January 1, 2008 or within 1 mile of the port of the city of Boston; provided, however, that the study may include, but shall not be limited to, examining respiratory and cardiovascular disease and cancer incidence that may be affected by exposure to traffic-related particles. The following departments and agencies shall provide information to the bureau relevant to this study: the department of environmental protection; the office of planning and programming within the Massachusetts Department of Transportation, the division of aeronautics; and the central transportation planning staff of the Boston metropolitan planning organization. The bureau shall report its findings together with suggested legislation, if any, to the house and senate committees on ways and means not later than June 30, 2010."

Comment #	Author	Topic	Comment	Response
F.1	Aaron Toffler, Esq.	Airport Planning	In the Certificate for the 2009 EDR, the Secretary specifically requires Massport to make assessment of the cumulative impacts of these projects a priority for the 2010 EDR. In addition, because Logan Airport is located in an Environmental Justice community, such an analysis is required. However, such an analysis appears nowhere in the 2010 EDR. Massport should be required to undertake such an analysis and report the results not only to the State, but also directly to the community.	A key purpose of the annual EDRs and ESPRs are the assessment of cumulative impacts of Logan Airport operations, including air quality, noise, and ground transportation effects on neighboring communities, including those designated as Environmental Justice communities. Cumulative effects are also addressed in specific project filings under the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA). For example, the Airside Improvements Program EIS included a detailed Environmental Justice assessment of the proposed improvement program elements where significant impacts were identified Massport makes all of its environmental filings available on its website where the public can access those documents. When a public meeting or hearing is held, notice of the meeting is published in a variety of media sources throughout the community and language translators are available upon advance request.
F.2	Aaron Toffler, Esq.	MEPA	Massport needs to make the information in the EDR available to all of the residents of East Boston and Chelsea in appropriate media and language to ensure that the public has a right to comment on these projects. Massport's failure to do so thus far has resulted in a significant portion of the community being left out of the public process in violation of the Commonwealth's Environmental Justice policy.	Massport will publish bi-lingual meeting and project notices and will make the services of an interpreter available upon request for the *2011 ESPR* and future EDR and ESPR filings.
F.3	Aaron Toffler, Esq.	Air Quality	The community herein reiterates its request that Massport fund a study of the impact on the adjoining community of ultra-fine particulate matter as a result of its operations.	The Massachusetts Department of Transportation (MassDOT) is developing a response to the analysis called for in the Transportation Reform Act. Massport will fund up to $150,000 once the format and scope of MassDOT's study is developed.
F.4	Aaron Toffler, Esq.	Air Quality	A similar study should be done to evaluate the impacts of ultra-fine particulate matter from Logan Airport's operations on the local community. Clearly such a study is required by Section 154 of Chapter 25 of the Acts of 2009 (the Transportation Reform Act). Massport should be required to undertake such a study.	Please see the previous response to Comment F.3.

Stephen H. Kaiser
191 Hamilton St.
Cambridge Mass.
02139

To : Richard Sullivan, Secretary of Energy and Environmental Affairs
MEPA Review Unit, 100 Cambridge Street Room 900
Attention : Anne Canaday, MEPA Unit

From : Stephen H. Kaiser, PhD

2010 Environmental Data Report EEA # 3247

For several years I commented in the annual EDR reports by Massport, but for the past couple of years other priorities interfered. Thus I would like to catch up on my responses, especially to give some comparisons with past EDR volumes. (My home library includes paper versions of the 1996 EIR update and EDRs for 2000, 2001, 2005, 2006, 2007, and 2008, as well as CDs of the 2004 ESPR and EDRs for 2006, 2007 and 2008.

In my comments of February 5, 2007, I noted the special value of Figure 2-13 in the 2005 EDR. This graph of national enplanement data from 1970 to 2004 showed a linear rise in passengers with variations to account for key events such as deregulation, wars, airline mergers and the effects of 9/11. In terms of planning, economics, and environmental impacts of airline activity, it demonstrated both general growth trends and the sensitivity to political events. The last appearance of this national data was in the 2008 EDR.

Unfortunately, the basic concept of the annual enplanement data has been dropped in the last three reports. I urge that this data be updated and restored in the next Massport report. I did find the graphical data in Chapter 2 to be vastly improved and instantly informative of trend data. Stated another way, the figures were more useful than the tables, and both were better than the text. G-1

The trend data in the EDR covers a period from 2004 or 2005 through 2010 -- six or seven years. Our experience of continuity with EDRs since 1997 suggests that the trend line can be extended next year from 1997 through 2011, which would be fifteen years. Massport has the data and has already been utilizing the graphical capabilities of computers.

The downside of additional data is that it makes any tables of numbers more difficult to comprehend. The common educational result for both citizens and Massport personnel is to increase math phobia or the phenomenon of eyes-glazing-over. The solution may be to continue the shorter-term data in the tables, but use the graphical figures to show the long-term trends.

Figure 2.1 illustrates peak Logan activity as year 2007, and a sudden drop thereafter. This result occurs well before the stock market crash of fall 2008 and the time when the alleged expert economists tell us the recession began. Such revelations suggest that it might be wiser to use MassPort data on passenger activity to forecast future economic conditions, rather than rely on economic statisticians on Wall Street or in Washington.

Figure 2-2 shows the annual passengers by the top five airlines at Logan over the period 2005 to 2010. The graphical nature of the data shows the trends -- it captures the decline of American Airlines and the rapid growth of JetBlue. American Airlines dropped from #2 at Logan to bankruptcy in only one year.

G-2 My concern with the text is that undue emphasis is on a single-year-to-year comparison. The larger context of the trends are lost, and the results are scrunched into a narrow window that sounds like company reports designed for Wall Street speculators, for whom short term profits and dividends are the primary concerns. To avoid these distortions, I urge than single year-to-year comparisons be dropped unless they highlight the beginning of a major change in trends.

SUSTAINABILITY

The discussion of sustainability on page 1-11 and following is better than most essays on the topic, but the reader can still get a feeling of inundation, vagueness and public relations. So many other sustainability studies have been vague, mushy and lacking in specifics, and much of the time a sustainability presentation feels like a double dose of PowerPoint.

I would welcome an effort by Massport to give “sustainability” greater practical meaning and significance. The best example is energy efficiency, as I will describe below.

ESPR SCHEDULE and ECONOMIC VARIABLES

G-3

I urge that the ESPR report not be delayed any further. It would be wise to avoid putting pressure on MEPA to change prior commitments and related decisions. The office is already encumbered with a steady stream of waiver requests, which have been granted at the rate of one a week for the last 5 years. I think the credibility of both MEPA and MassPort would be enhanced if Massport adhered to the original schedule of the 2011 report being an ESPR.

Massport has offered a justification for delaying the ESPR in order to revise the forecasts contained in the original 2004 ESPR. It would seem that the Authority is hoping for another growth year that would establish a more recent trend line towards growth. Such an assumption may be unjustified, and instead MassPort may need to contemplate alternate scenarios for the future.

From today's perspective, the general economic situation could take a path downward in the coming year. General trends toward more extensive electronic communications could support a general shift towards fewer flights and passengers in the foreseeable future. Such a shift in outlook is not easy for any organization. The example of the U.S. Postal Service provides an indication of the need to make adjustments for both expected and unexpected situations, especially if those changes may be unwelcome. The automobile manufacturers are facing the likelihood of lower auto sales because teenagers' dreams are now focused on electronic gadgetry and not on vehicles. Airline could find that passengers may prefer electronic gadgets to airport security checks -- to an alternative of being stranded on the tarmac for three hours or more.

The EDR indicates evidence of a “continued downturn in worldwide aviation activity” -- a recognition of a changing market and the need for Massport to make the necessary adjustments.

> **“As indicated in the 2009 EDR, several factors influenced Massport’s request to defer the next Logan Airport ESPR to reflect analysis of calendar year 2011. The primary factor is the continued downturn in worldwide aviation activity, which has led Massport to develop updated passenger and operations forecasts. .... The new forecasts use 2010 as the base year and develop and project aviation activity forward for calendar year 2030. The new forecasts will provide the basis of the ESPR’s modeled assessment of air quality, noise and other factors out to 2030.”**
>
> **(EDR Submission letter, Oct. 15, 2011)**

I would anticipate that the new forecasts could be internally controversial for Massport, because of the likelihood of dealing with a decline or contraction in operations and services. No bureaucracy anywhere likes to see its future through a reduction lens. Progress and optimism are tied into planning and growth. The realities of the future may hold a whole new experience for Massport planners.

G-4 The best solution may be to present two scenarios in the 2011 ESPR. One would present a scenario of tradition growth and recovery, somewhat less optimistic than in 2004. The second scenario would suggest a long-term contraction of airline services worldwide and at Logan.

The result could create a dramatic turnaround in impacts and perspectives. In 2007, FAA was warning of gridlock in the skies. My comment at the time ruminated on the implications of increased and decreased growth. Less airline activity could mean less noise, reduced emissions, less energy usage, motor vehicle congestion, less pressure for airport expansion outside of Logan. In other words, reduced activity at Logan would translate into lesser environmental impacts from airport operations. Reduced environmental impact is one of the objectives of MEPA!!

One objection from Massport could be the possibility that a two-scenario approach would increase the cost and complexity of the overall analysis. It need not if the growth scenario were modeled by CTPS in a fairly conventional manner, while the contraction model would simply be a linear extrapolation of the percentage changes of the growth model.

In my February 2007 comment (almost five years old), I asked,

> "Does growth go on forever? Or could plane ridership becomes like our magazines and newspapers, who in 2006 suddenly realized that they were in virtual free-fall for readers and advertising revenues? The print press has been predominant almost since Gutenberg, but its current decline reminds me of the railroads in the 1960s. How long before the travel industry is similarly afflicted?"

These words were written before the 2008 stick market crash and before the past two years of Eurozone financial crisis.

The economic crisis in Europe has been going on now for two years and shows no signs of permanent resolution. Even Germany may be in trouble for bank credit ratings and inability to sell bonds. New troubled countries may join the ranks of Greece, Spain, Italy, Ireland, Belgium, Iceland and other smaller nations whose economic security is perilous. I would suggest to Massport that a future of declining activity is more likely than a future of traditional growth.

INTERCITY RAIL and BUS ALTERNATIVES

I searched the text of the EDR for any mention of "railroad." I found one instance, a reference to Ross Capon of the National Association of Railroad Passengers. There is no discussion of the implications of Northeast Corridor rail service activities, for better or for worse in the report. Amtrak seems not to exist. G-5

Similarly, intercity bus operations appear not to be included, except for the briefest mention on page 5-21. In addition to the extensive and intensive bus competition for Boston to New York City, private bus lines such as Concord Trailways operate to bring in passengers from the northern New England coastal area, with some buses having direct connections to Logan.

NOISE CONTROLS

Massport, the Mass Aeronautics Commission, and the Federal Aeronautics Administration all serve a key function in dealing with one of the most intractable problems in modern society -- noise. Remarkably, the EPA has virtually no involvement in noise issues -- ever since the Reagan Administration abolished the noise office at EPA in the early 1980s. The state Department of Environmental Protection (and its predecessor agency DEQE) had virtually no involvement in noise issues, until someone realized the possibility of seeing noise as a form of air pollution. However, DEP regulations on mobile source noise emissions (car, bus, truck, motorcycle, snowmobile, train, plane) are virtually non-existent.

Interestingly, noise problems are generally handled by local airports, Federal and state airport agencies, the U.S. Congress and state Legislatures, and local noise control officials. Government environmental officials are virtually entirely out of the loop.

For noise problems at airports, the Massport and MAC take on primary roles for setting the standards, explaining them to the public and airline officials, and applying enforcement. To this extent, Massport gets to evaluate itself on its own regulations and compliance with them. I have never been happy with this monopoly, but the alternative is to rely on other state agencies who have no regulations or staff. Thus we must continue to work with Massport as best we can.

Noise is logarithmic in nature, and that throws 99% of the populace into bewilderment. The EDR makes no effort to clarify this difficult measurement system, to give examples and make the

whole aggravating situation meaningful to people. I worry that the decibel experts have intentionally or otherwise created a system that spreads bewilderment and a loss of confidence among members of the public. With Massport's responsibilities in the noise arena, I think it is incumbent on the staff to prepare a noise explanation that makes sense, and to try it out on other Massport staff who are not decibel experts, to see whether they "get it."

G-6

The noise issue is significant, because historians agree that the high point, the high water line of the modern environmental movement was in 1971 when Congress was persuaded not to invest in a Supersonic Jet Transport or SST. It was a stunning defeat for industry hopefuls like Boeing, and I believe contributed to the later stifling of noise regulation at all levels of government.

G-7 Stated bluntly : the noise section of the ESPR must be clear and fundamental, and produce readers who have a clearly improved understanding of noise problems.

ENERGY CONSERVATION

In the past two to three years, private and state efforts at energy conservation have shown stunning results. For example, the total energy budget of the MWRA has been reduced over two years by 20%, which I considered a remarkable achievement when I first heard of it.

Within the past year I learned of a private business initiative made by the EF company in Cambridge at North Point. In a purely voluntary effort, EF building officials achieved a 50 percent reduction in annual total energy use. Reduction in the use of electrical energy was even slightly higher at 60 percent. Meanwhile, state agencies have combined in an innovative energy program to work voluntarily with private entities to help reduce their energy use and practice energy conservation. The program has the potential to be widely popular, because businesses also reap the benefit of reduced energy costs, while the state agencies meet their goals for energy conservation and reduced carbon emissions. DEP and DOER have actively worked together with initial goals of 20 percent reductions in energy use. These were quickly achieved. Goals of 30 percent reductions were surpassed, and now goals of 50 percent energy savings are the norm.

I also have a friend, trained as an MIT physicist, who has been able to achieve a 50 percent reduction in electrical use by his Cambridge condo. In terms of achievable energy reductions, the figure of 50 percent keeps popping up. I attribute much of the success of these programs to the voluntary nature of the exchange and the benefits to businesses in terms of cost savings.

I am not aware of any <u>government agency</u> entering into similar voluntary agreements with DEP and DOER to seek improved energy efficiency. Such action would seem like a good initiative during the coming year. From the report, I was not able to get a sense for the overall Massport goals and projected benefits, but here again I suggest we begin with a goal of 50 percent energy savings by MassPort at Logan. The EDR reminds us that Massport is a relatively small user of all energy at Logan, mainly for heating and lighting.

The EDF refers to the Energy Management Plan for MassPort, but I could not get a sense for the goals and effectiveness of this program. The 2011 report should seek to give a summary and context for the energy programs at Logan. **G-8** The EDR refers top new solar panels on the roof of the Terminal B Garage, producing 166,000 kW of electricity a year, or approximately 5% of the garage's total annual electric power consumption. The figure should be kilowatt-<u>hours</u>, which is energy produced. This figure implies that the Massport element of energy use at Logan each year is 3,320,000 kWHr or 3.2 MWHr. **G-9** However, I could not find text or figures in the report which showed total electricity and other energy use. Thus I could get no sense for either the extent of Massport energy use or the effectiveness of its various energy programs.

The $55.7 million renovation of the garage includes installation of LED lighting. The claim of a 49 percent reduction in energy consumption is offered. This reduction is close to the stunning 50 percent reduction from other specific energy conservation programs. The Massport program needs to be clarified and placed in context of both overall energy use and measured savings. **G-10**

If Massport could work with DEP and DOER on an energy conservations program, the results could benefit the public beyond just Logan Airport. Other state agencies would have a role model to follow to engage in the same type of energy conservation program throughout the agency. The MBTA is the largest single user of electrical energy in the entire Commonwealth, and its energy savings could become very significant.

Sincerely,

Stephen H. Kaiser, PhD

cc. Stewart Dalzell, Massport
Jackie Wilkins, Massport

Comment #	Author	Topic	Comment	Response
G.1	Stephen Kaiser	Activity Levels	Unfortunately, the basic concept of the annual enplanement data has been dropped in the last three reports. I urge that this data be updated and restored in the next Massport report.	Annual enplanement data is provided every year in *Chapter 2, Activity Levels.* The chapter also provides a discussion of some of the uncertainties affecting passengers and airlines in the United States.
G.2	Stephen Kaiser	Activity Levels	My concern with the text is that undue emphasis is on a single-year-to-year comparison. The larger context of trends are lost, and the results are scrunched into a narrow window that sounds like company reports designed for Wall Street speculators, for whom short term profits and dividends are the primary concerns. To avoid these distortions, I urge that single-year-to-year comparisons be dropped unless they highlight the beginning of a major change in trends.	As stated in *Chapter 1, Introduction/Executive Summary,* the purpose of the EDRs is to provide year-to-year comparisons. The purpose of the ESPRs is evaluate trends which are occurring as well as to provide passenger activity levels and aircraft operations forecasts. Although EDRs report year-to-year comparisons, historical data from past years is presented as well in the appendices. This ESPR also predicts future trends with the inclusion of operations and passenger activity levels in 2030.
G.3	Stephen Kaiser	MEPA	I urge that the ESPR report not be delayed any further. It would be wise to avoid putting pressure on MEPA to change prior commitments and related decisions.	The *2011 ESPR* will be submitted to MEPA in Spring 2013 consistent with the deadline required in the Secretary's Certificate on the *2010 EDR.*
G.4	Stephen Kaiser	Activity Levels	The best solution may be to present two scenarios in the 2011 ESPR. One would present a scenario of traditional growth and recovery, somewhat less optimistic than in 2004. The second scenario would suggest a long-term contraction of airline services worldwide and at Logan.	The 2011 existing conditions provides information related to a no-growth scenario. The 2030 forecasts looks at potential long-term growth analysis.
G.5	Stephen Kaiser	Regional Transportation	I searched the text of the EDR for any mention of "railroad." I found one instance, a reference to Ross Capon of the National Association of Railroad Passengers. There is no discussion of the implications of Northeast Corridor rail service activities, for better or for worse in the airport.	*Chapter 4, Regional Transportation,* of the *2010 EDR* included a discussion on the Northeast Corridor rail service activities. The *2011 ESPR* also includes a discussion on rail service in *Chapter 4, Regional Transportation.*
G.6	Stephen Kaiser	Noise	With Massport's responsibilities in the noise arena, I think it is incumbent on the staff to prepare a noise explanation that makes sense, and to try it out on other Massport staff who are not decibel experts, to see whether they "get it."	Massport reviews all sections in an effort to make the document user-friendly. This *2011 ESPR* includes an introduction to noise terminology and acoustics in Appendix H to assist the reader with the noise analysis terminology.
G.7	Stephen Kaiser	Noise	Stated bluntly: the noise section of the ESPR must be clear and fundamental, and produce readers who have a clearly improved understanding of noise problems.	*Chapter 6, Noise Abatement,* provides a detailed description of the noise environment at Logan Airport, including the methodology used to model noise impacts.
G.8	Stephen Kaiser	Sustainability	The 2011 report should seek to give a summary and context for the energy programs at Logan.	A summary and context of the energy programs is provided in *Chapter 1, I ntroduction/Executive Summary.*

Comment #	Author	Topic	Comment	Response
G.9	Stephen Kaiser	Sustainability	The EDR refers to new solar panels on the roof of the Terminal B Garage, producing 166,000 kW of electricity a year, or approximately 5% of the garage's total annual electric power consumption. The figure should be kilowatt-hours, which is energy produced. This figure implies that the Massport element of energy use at Logan each year is 3,320,000 kWhr or 3.2 MWHr. However, I could not find text or figures in the report which showed total electricity and other energy use. Thus I could get no sense for either the extent of Massport energy use or the effectiveness of its various energy programs.	*Chapter 1, Introduction/Executive Summary,* provides an update on the Terminal B solar panel electricity generation. The Terminal B garage solar panels generated 238,000 kilowatt-hours (kWh) of electricity in fiscal year 2011 based on Massport tracking of these data. This is approximately 22 percent of total annual electricity consumption for the garage.
G.10	Stephen Kaiser	Sustainability	The $55.7 million renovation of the [Terminal B] garage includes installation of LED lighting. The claim of a 49 percent reduction in energy consumption is offered. This reduction is close to the stunning 50 percent reduction for other specific energy conservation programs. The Massport program needs to be clarified and placed in context of both overall energy use and measured savings.	*Chapter 1, Introduction/Executive Summary,* of the *2010 EDR* states that the installation of motion-detecting LED light fixtures use approximately 50 percent less electricity than the former lighting, which is an accurate statement.

Ennis, Tom

From: Hansen, Janeen
Sent: Friday, December 09, 2011 11:33 AM
To: Ennis, Tom
Subject: FW: Massport Logan 2010 EDR, EOEA #3247
Attachments: 19FR4602 MSA CAB 1954.pdf

FYI

From: Darryl Pomicter [mailto:dpomic@aol.com]
Sent: Friday, December 09, 2011 11:31 AM
To: anne.canaday@state.ma.us
Cc: Leo, Flavio; Dalzell, Stewart; Hansen, Janeen; 'BOS CAC'; info@bhcivic.org
Subject: Massport Logan 2010 EDR, EOEA #3247

Hello Anne,

Hoping for support from you and Secretary Sullivan, I repeat, expand, and detail my comments at the MEPA consultation session at Massport on November 16, 2011:

H-1 1. Massport's ESDR and EDR should be improved based on the BONS and BLANS Noise Abatement Study now being completed as a cooperative effort of the FAA, Massport, and the Logan CAC in mitigation for the Logan Airside Improvements Planning Project, EOEA #10458. Next year's "big picture" format ESDR is very appropriate to incorporate from the long Noise Abatement Study, as it is completing—to ensure ongoing monitoring, reporting and enforcement for compliance as agreed. Many of the comments below reflect learnings from that study. Others can be gained from reviewing the recent Phase II, Level 2 Screening Analysis and other documents from the BLANS website:
H-2 http://www.bostonoverflightnoisestudy.com/docs/BLANS_Level_2_Screening__FINAL_Full%20Document.pdf. And, a meeting with Massport and Logan CAC representatives would be beneficial.
H-3 The ESDR and EDR should be issued as quickly as possible in the following year, to maintain timeliness and relevance, both to avoid being out-of-date information and to enable prompt performance improvement when necessary. It seems that early September EDR and December ESDR should be manageable; not more than a year later (Introductory Letter and Appendix C).

H-4 2. Massport's 2010 EDR is a dense and complicated document, overall graphically well done and consistent. However, it needs improvements to allow and ease comprehension and use:
   H-5 a. Maps need the BOSTON VORTAC from which flight distances are measured, and Logan perimeter shown (including from the most basic, Figure 6-4). Dimensions are frequently to 0.1 mile, with more than 2 miles across Logan and the BOS VOR radio beacon at the southeast side (before the Runway 27 and 33L thresholds). Three miles from Logan DME
   H-6 may be less than a 1 mile from Logan perimeter. Tables such as 6-8 & 6-9 include "Distance from Logan Airport" which seems to be DME rather than perimeter, but it is not clear from where.
   H-7 b. Maps need Boston Communities and surrounding Cities names and boundaries—to ease correlation and improve understanding by people from below.
   H-8 c. The Noise Model description and all modeled noise levels graphics (including Tables 6-6, 6-7, 6-9 & 6-13 and Figures 6-13—6-15 and Tables H-7 & H-13) need to note clearly that the noise model, is calibrated with actual measurements, but is not actual measurements. Model noise levels need to note that the model and results do not include local VFR plane and helicopter flights, controlled by the Logan Tower, but not arriving or departing Logan. And, based on field measurements, they have been estimated to possibly double (+3dB) the noise model levels for the most affected communities. The small percentages of Logan

H-8 con't.

departures and arrivals which are not modeled directly from radar data should be detailed—general across categories or specific sub-categories (6-8—6-9, H-2 & H-11)?

H-9

d. Passengers, Operations, and Passengers/Operation should be shown for all airlines, including Cape Air—for which operations and passengers are currently not shown, even though it is a "Dominant Passenger Carrier" (Figure 2-5, Table 6-11, and Appendix E). Passengers/Operation should receive more detail and focus as a basic measure of efficient use of Massport and FAA facilities, noise, and emissions.

H-10

3. Massport should use current Internet tools to ease communications and increase review, discussion, and understanding:

H-11

a. Google Earth overlays should be made available and maintained to allow viewing the information, with respect to satellite photos ground conditions. A screenshot example from BLANS is below, comparable to Figures 6-6 to 6-16.

H-12

b. Massport should provide live online access at meetings to their website: http://www.massport.com/environment/environmental_reporting/Pages/EnvironmentalReporting.aspx, to linked documents including ESDR and EDR, and to Google Earth with KML overlays.

H-13

c. Massport's website should maintain links to their ESDRs and EDRs. The link to the most recent Logan Environmental Status and Planning Report remains broken, opening only the Table of Contents: http://www.massport.com/environment/environmental_reporting/Documents/TableOfContents.pdf—despite Massport's D.4 Response in Appendix B: "The links have been tested for accuracy."

H-14

d. Massport's Online Noise Complaint system should be updated to current technology, including recognize and partially input repeat users' contact details, email complaint with receipt acknowledgement, and respond by email—in less than the currrent many weeks: http://www.massport.com/environment/environmental_reporting/Noise%20Abatement/NoiseMonitor.aspx.

H-15

e. Massport's Airport Monitor system should be upgraded to current technology: http://www.massport.com/environment/environmental_reporting/Noise%20Abatement/AirportMonitor.aspx

H-16

4. Massport should fulfill the Logan Airside Improvements Planning Project (EOEA #10458) Mitigation Measure for Single Engine Taxi Procedures: <u>Develop and implement a program designed to maximize the use of single engine procedures by all tenant airlines, consistent with safety requirements, pilot judgment and Federal law requirements</u>—actively and ongoing. Massport now claims (Table 9-5) "Implemented", completed; but there has never been a Program developed or implemented. Several letters and voluntary surveys, years apart and simply informing, are not a program. Reporting that most already do some is not a Program. Expressing generally in favor of: "It is our hope that the current level of implementation will continue or be expanded" (Appendix M) is not the Program proposed and committed "to maximize...by all tenant airlines". A Program should be continuous, informing goals and progress to attain those goals (and appropriate adjustments)—tracking and sharing progress and lack of progress, to encourage all to improve. [Program: a plan of action to accomplish a specified end; a plan or schedule of activities, procedures, etc., to be followed.] The Program, in addition to single engine procedures to decrease emissions, should include single engine away from neighboring communities, toward centerfield to decrease noise effects.

H-17

5. Massport should work with the FAA to address noise complaints, including reporting response actions. Massport adds details to complaints and forwards a copy to the FAA and by mail to the complainer—after many weeks. Significant simplification editing of the complaint is common, and non-compliance of any kind is never acknowledged. Massport reports "Tracking of noise complaints" as a continuing element of their noise abatement program. But, there is no ongoing tracking. There is normally no response from the FAA. With thousands of complaints (personally dozens), no acknowledgement of violation or non-compliance and no corrective enforcement action is known. Complaints decrease from individuals and communities over time because there is no

H-18 change, not because the problems decrease (H-18—H-19). Massport should expand its current Flight Track Monitoring and reporting to include gross deviations from course and altitude standards, propeller and turboprop aircraft, and at least quarterly reporting—to aid and pressure the FAAA for enforcement, improved compliance, and decreased noise and emissions (H-28—H-29). Massport's relevant D.2 response in Appendix B is missing.

H-19

6. Massport should work with the FAA to improve compliance with the FAA's Minimum Safe Altitudes to increase safety and decrease noise and emissions: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=1c954411758b2f627dbe5c8d3e6da7e0&rgn=div8&view=text&node=14:2.0.1.3.10.2.4.10&idno=14. "Except when necessary for takeoff or landing," "Over any congested area of a city, town, or settlement, or over any open air assembly of persons, an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft." Massport's relevant D.6 response in Appendix B is missing.
   a. Currently, propeller and turboprop airplanes at Logan turn hard immediately after takeoff to clear the runway of the slower aircraft and allow a faster jet to proceed—24/7, even when there is no following takeoff (compare Figures 6-6 and 6-8 with 6-10). From Runway 22R, they are sometimes even less than 500ft over the already very heavily impacted Jeffries Point Neighborhood, East Boston, and commonly less than the minimum 1,000 feet higher within 2,000 feet of the Downtown Boston 600ft towers (an example Massport Noise Complaint, 1200ft Downtown Boston screenshot below). And, they continue 500-1,000ft lower than if in compliance, multiplying the noise at lower altitudes. (This noisy and needless, non-safety compliant procedure is standard for Cape Air, with more than 10% of Logan operations and less than 1% of Logan passengers.) Even the "good practice" of minimum 400 feet before turning, following other regulations, is not respected.
   b. The FAA's position is that "until the aircraft completes its climb out (and is in the enroute phase of flight) the route and altitude flown is "necessary for takeoff" and, therefore, there is no violation."
   c. The underlying, cited FAA Interpretations do not support that position; they are counter to it (base 1954 CAB Interpretation attached): "To achieve the proper high level of safety, it is vital that every pilot, consistently with sound and conservative operating practices, take full advantage of the performance capabilities of his aircraft so as to spend as little time as possible at altitudes below the minimums established for cruising flight. The "when necessary" language used in current § 60.17 achieves this result simply and directly. It prohibits low altitude flying-except when a departure from the otherwise applicable minimum is necessary for landing or taking off. It prohibits unnecessary low flying during the execution of those maneuvers. At every point along the proper flight path for approach to landing or climb after takeoff, an unnecessary dip would place the pilot in potential violation of this regulation." "It is a rule based on the standard of necessity, and applies during every instant that the airplane climbs after take-off and throughout its approach to land." Straight ahead, maximum climb, with minimum turn to minimize non-compliant flying and time is needed to satisfy the requirement. Hard turns at low altitudes, decreasing climb and increasing flying and time at lower altitude—choosing greater route distance and time non-compliant, rather than compliance sooner without turn—is certainly counter to the requirement. The FAA Pilot/Controller Glossary does not define "Takeoff" directly; it defines "CLIMBOUT- That portion of flight operation between takeoff and the initial cruising altitude." http://www.faa.gov/air_traffic/publications/atpubs/PCG/C.HTM. The excepted Takeoff is before Climbout, and Climbout is before En Route—Takeoff does not extend to En Route.
   d. (The Runway 27 jet departures turn from 270 to 235 at 2.2 DME and 760 MSL, also not in compliance with the Minimum Safe Altitudes, diverting substantial noise to (economically less advantaged) Roxbury and Roslindale (H-29). Since historically more than 40% still H-20
   miss the first gate turn, despite attempts to improve, it seems delaying the turn to more than 1,000 feet should be considered, including Minimum Safe Altitudes compliance (H-35).)
   e. (Massport monitors forecast operations, with peak periods of about 80-90 for only several hours, weekdays, and several months—30-50% excess capacity with the 120 capacity (Appendix K). Logan has had a safety incursion history in the top four nationally, much

greater than it should be with passengers 19th and operations 21st—they need to slow down to increase safety and decrease noise, which will not decrease actual throughput.)

Thank you for your help. I would be happy to discuss my comments further.

Sincerely

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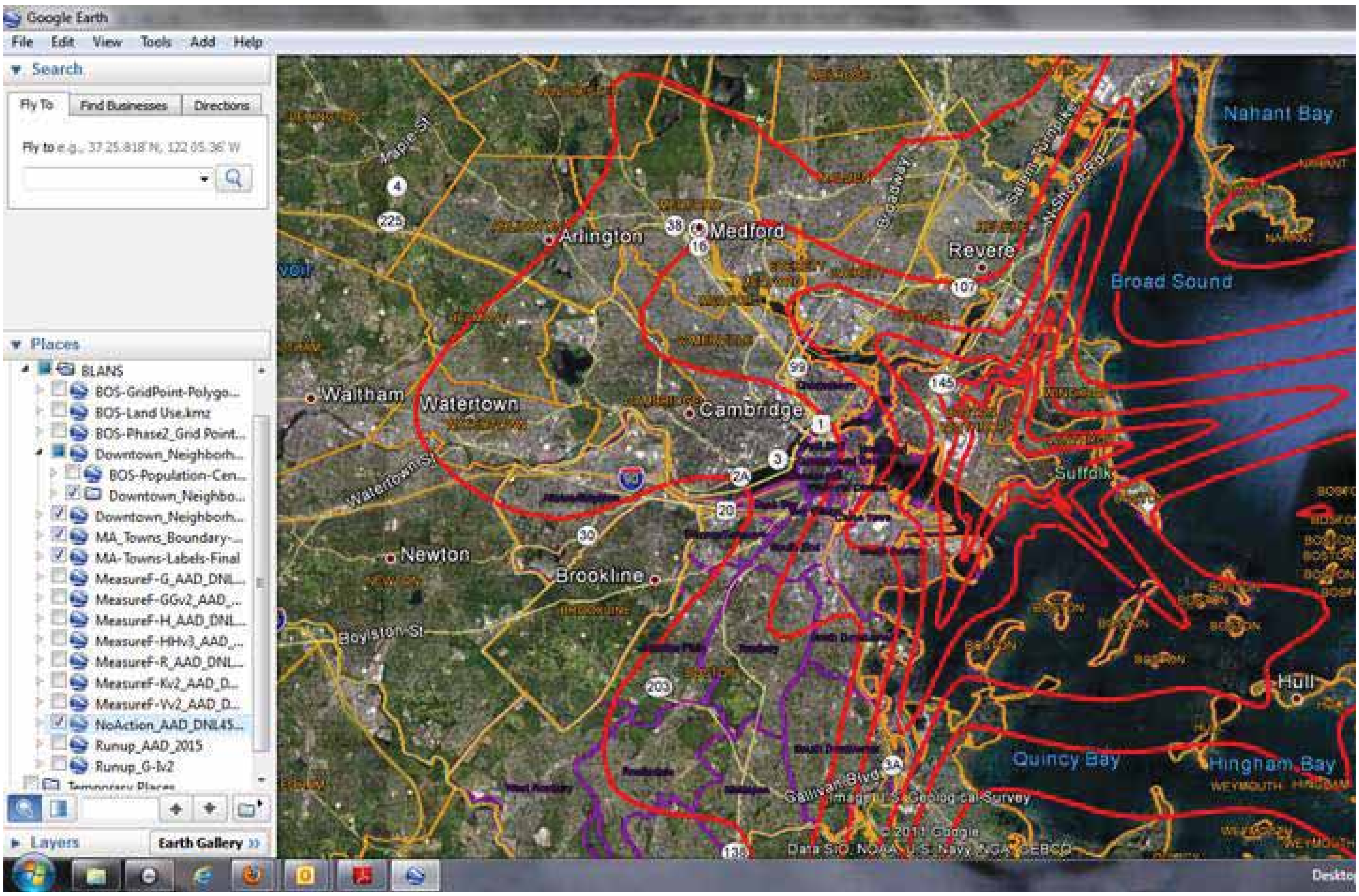

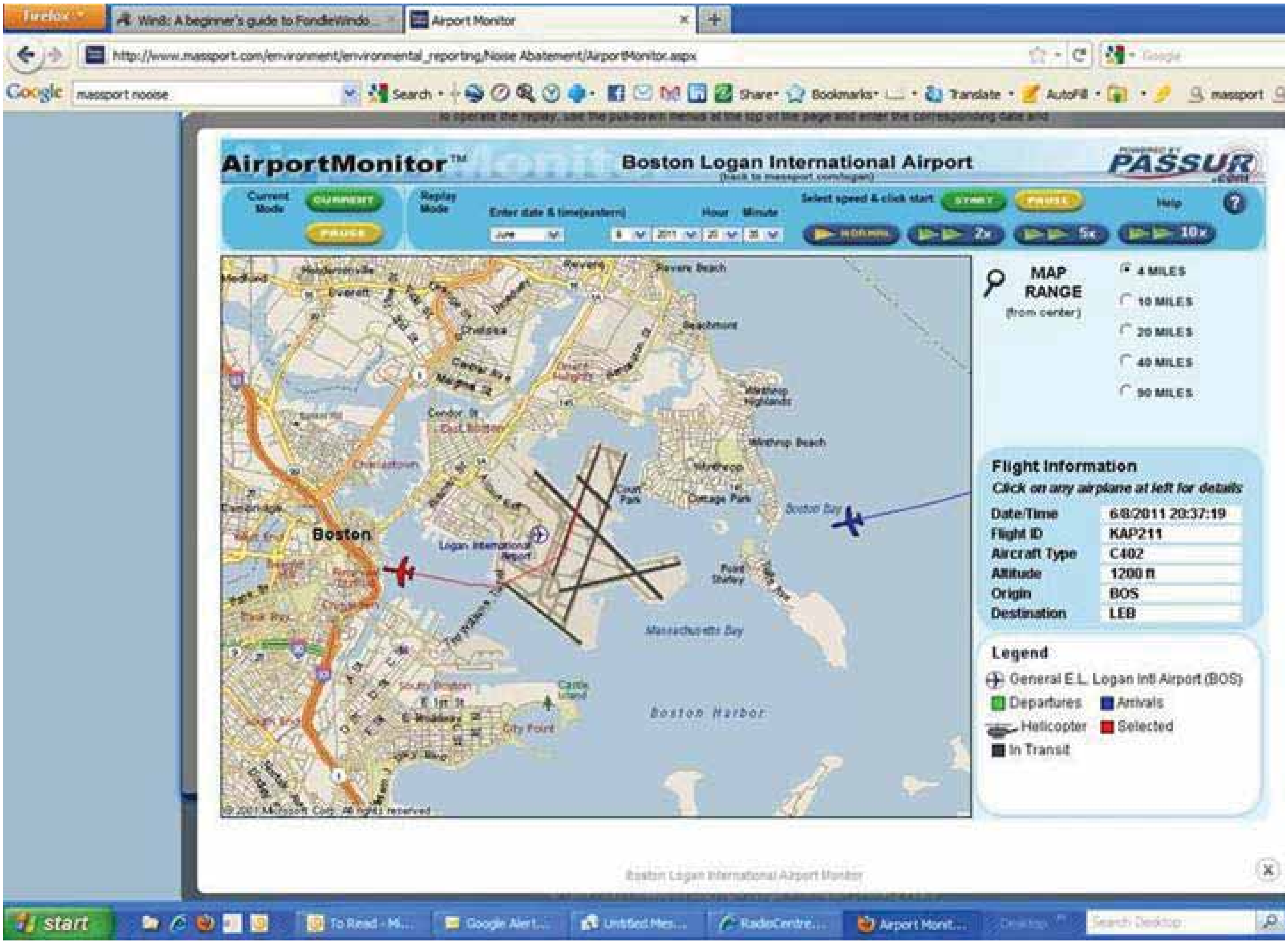

Richard K. Sullivan, Jr., Secretary
Executive Office of Energy and Environmental Affairs
Attention: Anne Canaday, MEPA Office, EEA #3247
100 Cambridge Street, Suite 900
Boston, MA 02114

From: Darryl Pomicter [mailto:dpomic@aol.com]
Sent: Saturday, November 10, 2012 4:57 PM
To: Terry.English@faa.gov; Leo, Flavio; 'Sandra Kunz'; 'jerry falbo'; 'declan boland'; 'wig zamore'; 'ralph dormitzer'; 'GARY BANKS'; [redacted]'costello larry'; 'D'Amico, Bob'[redacted]; alex.geourntas@cityofboston.gov; 'Ron Hardaway'[redacted] 'Lyman Will'[redacted]; rmaguire@norwoodma.gov; 'Terry McAteer'; 'Paul Meleedy'[redacted]'morrison dick'[redacted] 'parker, michael'; [redacted]smith pam'; 'John Stewart'; 'william sweeney'; 'mona thaler'; 'thaler mona'; 'thaler mona'; 'JONATHAN WALZER'[redacted]; 'bill deignan'[redacted] 'patti fine'[redacted]mlindstrom@cityofmelrose.org; [redacted]alan wright'; bryan.glascock@cityofboston.gov[redacted]maura.zlody@cityofboston.gov
Cc: 'John Williams'; 'Rob Adams'; Dalzell, Stewart; anne.canaday@state.ma.us; mayor@cityofboston.gov; 'BOS PMT'
Subject: Logan Departures and Arrivals--by Runway End & PRAS

Folks

Attached is a spreadsheet with analysis of Logan Departures and Arrivals by Runway. The goal is to give a clearer view of who is affected, how much, relative to others, and changing over years. The 1990-2010 data is from Massport's 2010 Environmental Data Report, Table H-12, Summary of Jet Aircraft Runway Use – 1990-2010 and Table 6-5, Effective Jet Aircraft Use in Comparison to PRAS Goals: http://www.massport.com/environment/environmental_reporting/Documents/EDR/2010EDR_Part_1_Main.pdf. The earlier PRAS data is from Massport's 1989 ENPRAS Interim Report, PRASSUM File and 2008 EDR. [Massport notes 1991 Runway Use unavailable, and I haven't found 1989.]

Massport and the FAA typically list Runway Use, Departures and Arrivals by Runway Direction. Since Departures and Arrivals are both into the wind, in the same direction they operate at the opposite ends of the Runway. Departures from a Runway are over a totally different area and community of people than Arrivals to that Runway—around the opposite end, miles away. The PRAS goals agreed in 1982 (but never achieved) are annual Runway End utilization percentages for Departures and Arrivals. (PRAS has not operated since the FAA upgraded their systems in 2004.)

So, I have arranged the Departures from each Runway End with the Arrivals to the same Runway End—over the same area and community of people—and added totals. (Each physical runway has two names: the direction (and position) from one end and the direction (and position) from the opposite end, 180 degrees apart—for example, Runway 22 Right and Runway 4 Left.) The first sheet is the actual use and the second sheet is the effective use, with 10X nighttime adjustment for PRAS.

Also, I have added multi-year averages for 2007-2010 with full-year operation of the new Runway 14-32; the prior years 2001-2006; the longer period 1990-2006, and PRAS 1984-1989. There are significant changes in multi-year averages, which change relatively slowly (and are not as large as some shorter period observations and comparisons).

Comparing Jet Departures and Arrivals from each Runway End (and realizing that Departures are generally noisier than Arrivals) shows clearly (consistent with the Google Earth noise contours, and very different than Runway Direction percentages) that:

1. Runway 22 Left Departures with Runway 4 Right Arrivals and Runway 22 Right Departures with Runway 4 Left Arrivals over South Boston, Dorchester, Milton, Quincy, and adjacent, and Runway 9 Departures with Runway 27 Arrivals over Winthrop are the very greatest problems—each with more than 30%.
2. Runway 4 Right Departures with Runway 22 Left Arrivals over East Boston, Winthrop, Revere, Lynn, and adjacent; Runway 33 Left Departures with Runway 15 Right Arrivals over East Boston, Chelsea, Charlestown, Medford, Everett, Somerville, and adjacent; and Runway 15 Right Departures with Runway 33 Left Arrivals over the Outer Harbor, Hull, Hingham, Cohasset, and adjacent are the next rank—each with about 10%).
3. Runway 27 Departures with zero (never used) Runway 9 Arrivals over South Boston, Chinatown, Financial District, South End, Roxbury, and adjacent is the third rank—with about 5%). And, the new Runway 14 Departures with Runway 32 Arrivals over the Outer Harbor and Hull is very small (and with no large jets)—about 1%.

From 2007-2010, with the opening of the new Runway 14-32,

1. The greatest problems, Runway 22 Right Departures with Runway 4 Left Arrivals and Runway 9 Departures with Runway 27 Arrivals both increased, while Runway 22 Left Departures with Runway 4 Right Arrivals decreased.
2. In the second rank, Runway 4 Right Departures with Runway 22 Left Arrivals and Runway 33 Left Departures with Runway 15 Right Arrivals both increased, while Runway 15 Right Departures with Runway 33 Left Arrivals decreased (despite being a primary PRAS goal to maximize these, over water—to agreed goals more than triple, to be top rank).
3. In the third rank, Runway 27 Departures with zero Runway 9 Arrivals decreased.
4. The PRAS Runway End utilization goals agreed in 1982 have never been achieved, never close—even with the change from all aircraft to only jets (<85%) in the implementation of ENPRAS in the '90s. The PRAS computer program is not even operating since 2004. The Long-Term Goal (after "Reduce the annual average total noise impact…"): "Maximize the use of runway 15R for over water departures and 33L for over water arrivals." seems to be lost—with the greatest consequent increase to Runway 9 Departures and Runway 27 Arrivals over Winthrop (a greatest problem with more than 30% actual use). (PRAS excerpts below.)

H-21 This does not discount any of the difficulties we suffer—noise, air quality, and other—but rather tries to see them more clearly and scale them, realizing some have it even worse than others. This is intended to show more clearly who is getting hammered—how much, relative to others, and changes over time. Hopefully, we can use it to help decrease negative effects and distribute them more equitably over time. Runway End utilization is the basis of PRAS, and it should be reported clearly—and be part of revamping, updating, reassessing, superseding PRAS as provided in the ROD.

Non-jet, turboprop and piston prop are not currently included. They are currently about 15% of the total (about 18% as large as the jets). 2010 EDR: Table 2-2 Logan Airport Aircraft Operations. **(**And, that seems likely to increase significantly as turboprops compete with increased efficiency and larger sizes to replace some of the about 20% regional jets—which replaced non-jets around 2000-2002.) The FAA turns the non-jets early, before the end of the Runway—to decrease their standard 3 miles minimum separation (and sometimes 5) to "1 mile if courses diverge immediately after departure" "by 15 degrees or more". FAA Order 7110.65R

Air Traffic Control, 5-5-4 Minima and 5-8-3 Radar Departures: www.faa.gov/documentlibrary/media/order/atc.pdf. (They turn very early and very low over already very heavily impacted nearby communities. They don't wait until the end of the runway (as the decreased minimum is drawn), or follow the FAA's Minimum 400 Feet Before Turning standards, or consider whether there is any following aircraft or not (to benefit from the increased Efficiency and decreased Safety). And, they don't comply with the FAA's Minimum Safe Altitudes 1,000 higher than within 2,000 feet, except when necessary.)

(Also, Helicopters and Non-Logan arriving or departing planes are not included; which as much as double reported noise in the most-affected Downtown, Inner-City neighborhoods.)

I'm copying Massport, FAA, and Massachusetts Department of Environmental Protection. I request Massport include this Runway End utilization view with totals in their annual EDR, starting with their 5-year 2011 Environmental Status and Planning Report (delayed from 2009, for delivery in 2013). It should be included for both the actual use and the effective use for PRAS, which includes 10X nighttime. For Massport and the FAA, I think it is very important to manage and report clearly the total activity (turbojet, turboprop, and piston prop) by Runway End use (actual and effective)—including as part of revamping, updating, reassessing, superseding PRAS as provided in the ROD—to more clearly see the absolute and relative effects over time on Communities, and to more equitably decrease and distribute them. **H-22**

Sincerely,

Darryl

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PS I've been checking my spreadsheet for errors; but, of course, some remaining is possible. Please advise. Massport's 2010 EDR reports 2000 Arrivals 4R as 50%, which I have corrected to 40% to be consistent and total 100%.) **H-23**

PPS

PRAS Goals and Compliance

The goals for the automated PRAS at Logan were established by the advisory committee to the development of the original computerized development in 1980-83. The advisory committee was composed of representatives from Massport, the FAA, airlines, and 12 neighboring communities. It concluded that the PRAS should provide an equitable distribution of aircraft noise over the long-term (i.e. annually), as well as short-term relief from excessive operations over certain neighborhoods.

Long-Term Goals

The PRAS advisory committee agreed that the long-term goals should:

* Reduce the annual average total noise impact from Logan operations on the population residing in affected communities, without significantly increasing the impact on any populated area within the day-night sound level (Ldn) contour of 65dB; and

* Maximize the use of runway 15R for over water departures and 33L for over water arrivals.

To quantify the long-term noise goals, the committee reached a consensus on annual runway end use percentages in terms of equivalent jet operations. Equivalent operations include all daytime (7 am to 10 pm) jet flights, plus nighttime (10 pm to 7 am) jet operations multiplied by a factor of ten. This is consistent with the methodology for computing Ldn, in which 10 dB are added to nighttime operations. The agreed annual runway end use goals are shown in Table 1.

Table I. Logan Runway Utilization Goals for PRAS.

Runway Operation	Effective Utilization
Arr 04	21.2
Arr 15	8.4
Arr 22	6.5
Arr 27	21.7
Arr 33	42.3
Dep 04	5.6
Dep 09	13.3
Dep 15	23.3
Dep 22	28.0
Dep 27	17.9
Dep 33	11.9

THIRD: The Government shall use the data provided through the PRAS to assist in the Government's decision making in selecting the runways to be used for aircraft landing and departing Logan International Airport. Nothing herein shall be construed to alter the requirement that all decisions as to use of the navigable airspace, including selection, shall remain the sole responsibility of the Government to the extent required under the Federal Aviation Act as amended and other applicable provisions of law.

B. Flight Track data for all in-flight activity described in Paragraph A above, 24 hours a day, 7 days a week for Commercial and General Aviation aircraft. Data shall not include military operations, aircraft incidents, or any other information deemed sensitive at the sole discretion of the FAA.

Traffic Data. The forecast traffic demand will be entered in two forms. The normal demand profile of arrivals and departures by time of day and day of week will be provided by Massport and/or the FAA. These profiles will be updated on a monthly or seasonal basis from the airline schedules and MPA estimates of non-scheduled and general aviation activity. The profiles will be generated off-line and input from diskette or remotely via a communications link. The data will include expected turbojet and non-turbojet operations by 15-minute intervals, and perhaps an adjustment factor for prevailing weather conditions.

Noise History. In order to determine the performance of ENPRAS, the Area Supervisor may call up a window showing the noise history. This display will show the current noise values by runway end: per cent runway end use over the past 12 months, annual runway end use goals, dwell and persistence. More detailed historical data may also be requested, including summary tables of runway end usage for the calendar year. Other historical displays may be included during the system implementation, based on needs expressed by the FAA and/or Massport.

Comment #	Author	Topic	Comment	Response
H.1	Darryl Pomicter	Noise	Massport's ESPR and EDR should be improved based on the BONS and BLANS Noise Abatement Study now being completed as a cooperative effort of the FAA, Massport, and the Logan CAC in mitigation for the Logan Airside Improvements Planning Project, EOEA #10458.	The status of the Boston Overflight Noise Study (BONS) and BLANS are reported in the *2011 ESPR.* For updated information on this study, see the website: http://www.bostonoverflight.com/phase2_documents.aspx#Level1Report.
H.2	Darryl Pomicter	Noise	And, a meeting with Massport and Logan CAC representatives would be beneficial.	There will be a public meeting on the 2011 ESPR where the public and the CAC can attend and provide feedback to Massport and the MEPA office.
H.3	Darryl Pomicter	MEPA	The ESDR and EDR should be issued as quickly as possible in the following year, to maintain timeliness and relevance, both to avoid being out-of-date information and to enable prompt performance improvement when necessary. It seems that early September EDR and December ESPR should be manageable; not more than a year later (Introductory Letter and Appendix C).	Massport maintains the schedule approved by the MEPA Office for the submittal of EDRs and ESPRs. As noted in the *2010 EDR* , the *2011 ESPR* will be submitted in Spring 2013 to accommodate incorporating the most recently available information from the updated operations and passenger forecasts and key airport planning efforts.
H.4	Darryl Pomicter	General	Massport's 2010 EDR is a dense and complicated document, overall graphically well done and consistent. However, it needs improvements to allow and ease comprehension and use.	Massport continually works to improve the text, maps, and graphics in all of their filings, including the EDRs and ESPRs. This includes developing new ways to present data in a easily understood and graphically pleasing fashion. For example, neighborhood names have been added to a number of graphics to help orient the reader.
H.5	Darryl Pomicter	Noise	Maps need the BOSTON VORTAC from which flight distances are measured, and Logan perimeter shown (including from the most basic, Figure 6-4).	The distances from Logan Airport in Tables 6-8 and 6-9 are from the Airport Reference Point (ARP) which is marked on Figure 6-4 and Figure 6-16. The ARP is the geographic center of the runway ends and is commonly used as the geographic location of an airport.
H.6	Darryl Pomicter	Noise	Tables such as 6-8 & 6-9 include "Distance from Logan Airport" which seems to be DME rather than perimeter, but it is not clear from where.	The distance is from the airport reference point. This is noted in *Chapter 6, Noise Abatement,* of this *2011 ESPR* .
H.7	Darryl Pomicter	General	Maps need Boston Communities and surrounding Cities names and boundaries—to ease correlation and improve understanding by people from below.	Please see the response to Comment H.4.

Comment #	Author	Topic	Comment	Response
H.8	Darryl Pomicter	Noise	The Noise Model description and all modeled noise levels graphics (including Tables 6-6, 6-7, 6-9 & 6-13 and Figures 6-13—6-15 and Tables H-7 & H-13) need to note clearly that the noise model, is calibrated with actual measurements, but is not actual measurements. Model noise levels need to note that the model and results do not include local VFR plane and helicopter flights, controlled by the Logan Tower, but not arriving or departing Logan. And, based on field measurements, they have been estimated to possibly double (+3dB) the noise model levels for the most affected communities. The small percentages of Logan departures and arrivals which are not modeled directly from radar data should be detailed— general across categories or specific sub-categories (6-8—6-9, H-2 & H-11)?	The INM model is not calibrated by actual noise measurements at Massport. The modeling includes only those aircraft operations that land or depart from Logan Airport. Massport has not undertaken any field measurements which show a possible doubling of noise levels due to local VFR (visual flight rules) plane or helicopter traffic. All of the departures and arrivals from Logan Airport are modeled directly from the radar data. This information is then used as a basis for scaling the operations on the available radar tracks. Commercial operations are scaled by airline and general aviation operations are scaled to the total general aviation count.
H.9	Darryl Pomicter	Activity Levels	Passengers, Operations, and Passengers/Operation should be shown for all airlines, including Cape Air—for which operations and passengers are currently not shown, even though it is a "Dominant Passenger Carrier" (Figure 2-5, Table 6-11, and Appendix E). Passengers/Operation should receive more detail and focus as a basic measure of efficient use of Massport and FAA facilities, noise, and emissions.	The efficiency of Logan Airport in terms of the number of passengers per aircraft operation has increased significantly. In 2000, Logan Airport accommodated an average 56.8 passengers per aircraft operation. Since then, airlines have retired many small turboprops and regional jets and are operating flights with more passengers onboard. As a result, the average number of passengers per aircraft operation has risen by 38 percent to 78 percent. Cape Air continues to operate 9-seat aircraft which are ideally suited to serving the Cape and Island markets with seasonal traffic fluctuations. See *Chapter 2, Activity Levels,* for a discussion of the average number of passengers per aircraft operation.
H.10	Darryl Pomicter	General	Massport should use current Internet tools to ease communications and increase review, discussion, and understanding.	Massport's website provides a number of resources that ease communications and increase review, discussion, and understanding. The website provides links to recently filed environmental documents. Detailed information is provided on environmental reporting to help the layperson understand the meaning of environmental reporting for noise, water quality, and air quality. The website also provides tips on how to travel in an environmentally friendly way. The website URL is: http://www.massport.com/environment/Pages/Default.aspx.
H.11	Darryl Pomicter	General	Google Earth overlays should be made available and maintained to allow viewing the information, with respect to satellite photos ground conditions. A screenshot example from BLANS is below, comparable to Figures 6-6 to 6-16.	Massport has been expanding the use of satellite photos as the technology evolves. Please see Figures 6-6 to 6-14.

Comment #	Author	Topic	Comment	Response
H.12	Darryl Pomicter	General	Massport should provide live online access at meetings to their website, to linked documents including ESPR and EDR, and to Google Earth with KML overlays.	Massport will have an electronic copy of the ESPR at the public meeting.
H.13	Darryl Pomicter	General	Massport's website should maintain links to their ESDRs and EDRs. The link to the most recent Logan Environmental Status and Planning Report remains broken, opening only the Table of Contents—despite Massport's D.4 Response in Appendix B: "The links have been tested for accuracy."	The Massport website has accurate links. Unfortunately, due to size restrictions, the only portion of the *2004 ESPR* that could be linked on the website is the Table of Contents. CDs are available on request. More recent environmental filings include the entire reports and links are posted on Massport's website.
H.14	Darryl Pomicter	Noise	Massport's Online Noise Complaint system should be updated to current technology, including recognize and partially input repeat users' contact details, email complaint with receipt acknowledgement, and respond by email—in less than the current many weeks.	Thank you for your input. Massport is continually improving its information sharing with interested citizens including the opportunity to submit information via email and the Airport Monitor system.
H.15	Darryl Pomicter	Noise	Massport's Airport Monitor system should be upgraded to current technology.	The Airport Monitor system is an important tool used by citizens every day. Opportunities to upgrade the system will be considered in the future.
H.16	Darryl Pomicter	Mitigation	Massport should fulfill the Logan Airside Improvements Planning Project (EOEA #10458) Mitigation Measure for Single Engine Taxi Procedures: Develop and implement a program designed to maximize the use of single engine procedures by all tenant airlines, consistent with safety requirements, pilot judgment and Federal law requirements—actively and ongoing. Massport now claims (Table 9-5) "Implemented", completed; but there has never been a Program developed or implemented.	Massport continues to work with FAA and the BLANS team on voluntary single engine taxiing measures. Massport continues to encourage its use and, based on recent surveys, airlines are deploying this strategy on a voluntary basis where possible. In 2011, Massport issued a memorandum to air carriers encouraging the use of single engine taxiing when consistent with safety which was attached to the *2010 EDR* .
H.17	Darryl Pomicter	Noise	Massport should work with the FAA to address noise complaints, including reporting response actions.	Massport works cooperatively with the FAA on a number of issues, including addressing noise complaints and response actions.
H.18	Darryl Pomicter	Noise	Massport should expand its current Flight Track Monitoring and reporting to include gross deviations from course and altitude standards, propeller and turboprop aircraft, and at least quarterly reporting—to aid and pressure the FAA for enforcement, improved compliance, and decreased noise and emissions (H-28—H-29). Massport's relevant D.2 response in Appendix B is missing.	Massport provides extensive data in the EDRs and ESPRs including noise monitoring results, flight tracks, and emissions. Massport also provides specific analyses when requested. This information forms the basis for dialogues with the FAA and communities. Unfortunately, the D.2 response in Appendix B of the *2010 EDR* was accidentally omitted. The response to D.2 is as follows: *Massport and the FAA work cooperatively to address and to respond to noise complaints.*

Comment #	Author	Topic	Comment	Response
H.19	Darryl Pomicter	Noise	Massport should work with the FAA to improve compliance with the FAA's Minimum Safe Altitudes to increase safety and decrease noise and emissions "Except when necessary for takeoff or landing," "Over any congested area of a city, town, or settlement, or over any open air assembly of persons, an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft." Massport's relevant D.6 response in Appendix B is missing.	Massport provides information to the FAA when requested and continues to work with the FAA on low altitude aircraft over Boston and the neighboring communities. Unfortunately, the D.6 response in Appendix B of the 2010 EDR was accidentally omitted. The response to D.6 is as follows: *The FAA advises pilots on which runways to use and when. The FAA (Air Traffic Control) is also responsible for safe flight procedures and directs aircraft to fly in a safe and efficient manner. Massport works with the FAA to maintain a safe and efficient Airport.*
H.20	Darryl Pomicter	Noise	Since historically more than 40% still miss the first gate turn, despite attempts to improve, it seems delaying the turn to more than 1,000 feet should be considered, including Minimum Safe Altitudes compliance (H-35)	Since March of 2011, the Runway 27 procedure has been improved and more than 70 percent of the departures are passing through the first gate.
H.21	Darryl Pomicter	Noise	This does not discount any of the difficulties we suffer—noise, air quality, and other—but rather tries to see them more clearly and scale them, realizing some have it even worse than others. This is intended to show more clearly who is getting hammered—how much, relative to others, and changes over time. Hopefully, we can use it to help decrease negative effects and distribute them more equitably over time. Runway End utilization is the basis of PRAS, and it should be reported clearly—and be part of revamping, updating, reassessing, superseding PRAS as provided in the ROD.	Massport, the FAA, and the CAC will begin discussions on runway use measures as part of the final phase of the noise study to the extent that new reporting requirements are developed. The ESPRs and EDRs would report on these measures.
H.22	Darryl Pomicter	Noise	I'm copying Massport, FAA, and Massachusetts Department of Environmental Protection. I request Massport include this Runway End utilization view with totals in their annual EDR, starting with their 5-year 2011 Environmental Status and Planning Report (delayed from 2009, for delivery in 2013). It should be included for both the actual use and the effective use for PRAS, which includes 10X nighttime. For Massport and the FAA, I think it is very important to manage and report clearly the total activity (turbojet, turboprop, and piston prop) by Runway End use (actual and effective)—including as part of revamping, updating, reassessing, superseding PRAS as provided in the ROD—to more clearly see the absolute and relative effects over time on Communities, and to more equitably decrease and distribute them.	Please see the response to Comment H.21.
H.23	Darryl Pomicter	Noise	I've been checking my spreadsheet for errors; but, of course, some remaining is possible. Please advise. Massport's 2010 EDR reports 2000 Arrivals 4R as 50%, which I have corrected to 40% to be consistent and total 100%.)	Please see the response to Comment H.21.

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December 9, 2010

The Honorable Richard K. Sullivan, Jr., Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Subject: EOEA #3247-Logan Airport 2010 Environmental Data Report (EDR)

Dear Secretary Sullivan:

These comments are being transmitted by email.

I have reviewed the 2010 Environmental Data Report (EDR), EOEA #3247 and offer the following comments and questions, with particular reference to the Noise section (6).

I-1 On page 6-4, there is a nice write-up on noise metrics. The definition for decibel is not the general one, which is simply 20 times the common logarithm of a ratio of the sound pressure of interest to a reference pressure. The reference pressure for noise or communities, 20 micro-Pascals, is what the paragraph tried to describe. Further, although A-weighted levels are referenced under DNL, it is not defined. If this section is included in future documents, A-weighting should be defined.

I-2 On page 6-8, it appears that the number of traces (360,402) is greater than the number of operations (352,644). Please explain this discrepancy.

I-3 The footnotes to Table 6-1 on page 6-12 are incorrect (i.e., there is no note 5).

I-4 What is the basis for the noise comparison in Figure 6-2 on page 6-14 (is it CNI)?

I-5 On page 6-18, Runway 9/27 is included in the N/S. It is, however, by definition, an east/west runway (heading close to 90 degrees and 270 degrees). The 14/32 and 15/33 runways are more northwesterly/southeasterly. This section should be reworked.

I-6 On page 6-21, the conclusion might be that the airport is getting closer to achieving the PRAS goals without having the PRAS operational. How do you account for this?

In Figure 6-6, there are a number of jet departure tracks from Runway 22R visible which I-7
are flying over the City. Does Massport work with the FAA to eliminate such behavior?

A comparison on Figures 6-7 and 6-9 implies that commercial jets have more extreme I-8
dispersion on arrival than the regional jets. Why is this so?

On page 6-35, it would be more useful to omit the 80+ DNL column, and instead I-9
introduce a 60+ DNL column.

On page 6-41, in Table 6-9, the measured versus modeled results appear to have an I-10
incorrect sign. When the measured values are higher than the modeled, the sign of the result should be positive.

On page 6-42, it appears that the airport knows what operation it was that was Stage 2 at I-11
night in 2010. Was the operator of that operation prosecuted under the Noise Rules?

On page 6-51, you note that the new system has a way to correlate complaints with flight I-12
paths. How is this information being used? Do you contact the carriers and/or the FAA?

On page 6-54, Northwest's operations in the years prior to merging with Delta should I-13
have been reported in Table 6-14, for completeness.

In the next Environmental Status and Planning Report (ESPR), Massport and its I-14
consultants should provide a discussion of likely speech and sleep interference from the jet arrivals and departures from Boston-Logan International Airport. Time above (TA), which is reported in Tables 6-13 and -14, can be used to get a measure of the problem.

Thank you for giving me the opportunity to comment on this report.

Sincerely,

PE

Nancy S. Timmerman, P.E.

cc: J. Hansen, Massport
S. Dalzell, Massport
Letter to MEPA Office/EOEA #3247--2010EDR

Member Firm, National Council of Acoustical Consultants

Comment #	Author	Topic	Comment	Response
I.1	Nancy S. Timmerman	Noise	Further, although A-weighted levels are referenced under DNL, it is not defined. If this section is included in future documents, A-weighting should be defined.	The definition of A-weighting has been provided in *Chapter 6, Noise Abatement.*
I.2	Nancy S. Timmerman	Noise	On page 6-8, it appears that the number of traces (360,402) is greater than the number of operations (352,644). Please explain this discrepancy.	The greater number of traces is due to partial or broken tracks and tracks that flew close to the airport but did not land or depart the airport. These are assigned to Logan Airport, but do not have runway assignments. In 2011, 349,397 tracks had aircraft information and runway assignments.
I.3	Nancy S. Timmerman	Noise	The footnotes to Table 6-1 on page 6-12 are incorrect (i.e., there is no note 5).	The footnotes to Table 6-1 in the *2010 EDR* were incorrect as noted in the comment. The footnotes in the similar table in the *2011 ESPR* are correct.
I.4	Nancy S. Timmerman	Noise	What is the basis for the noise comparison in Figure 6-2 on page 6-14 (is it CNI)?	This is based on the CNI analysis and will be noted in the *2011 ESPR* .
I.5	Nancy S. Timmerman	Noise	On page 6-18, Runway 9/27 is included in the N/S. It is, however, by definition, an east/west runway (heading close to 90 degrees and 270 degrees). The 14/32 and 15/33 runways are more northwesterly/southeasterly. This section should be reworked.	Runway 9-27 is included with the North/South flow analysis due to the runway configurations that utilize the runway. North flow typically includes arrivals to Runways 4L-4R and departures from Runways 4R or 9. South flow typically includes arrivals to 22L and 27 with departures from Runways 22L-22R.
I.6	Nancy S. Timmerman	Noise	On page 6-21, the conclusion might be that the airport is getting closer to achieving the PRAS goals without having the PRAS operational. How do you account for this?	Even without the Preferential Runway Advisory System (PRAS) operational, the FAA and Massport work to keep overflights over non-sensitive areas whenever practicable and to distribute overflights over sensitive areas so that no one area is highly exposed.
I.7	Nancy S. Timmerman	Noise	In Figure 6-6, there are a number of jet departure tracks from Runway 22R visible which are flying over the City. Does Massport work with the FAA to eliminate such behavior?	The majority of the tracks shown flying over the City are at higher altitudes; these flights departed the airport using their normal procedure and then passed over the city. These flights are not typical and were deviated by the FAA due to weather or operational reasons.
I.8	Nancy S. Timmerman	Noise	A comparison on Figures 6-7 and 6-9 implies that commercial jets have more extreme dispersion on arrival than the regional jets. Why is this so?	The dispersion is similar for both types of aircraft, however there are more commercial jets so the dispersion for commercial jets appears more prevalent in the graphic. In addition, Regional Jets also use the west downwind and the commercial jets typically use just the east downwind.
I.9	Nancy S. Timmerman	Noise	On page 6-35, it would be more useful to omit the 80+ DNL column, and instead introduce a 60+ DNL column.	The 80+ dB column had been included for historical reasons. The 60 dB results are reported in *Appendix H* .
I.10	Nancy S. Timmerman	Noise	On page 6-41, in Table 6-9, the measured versus modeled results appear to have an incorrect sign. When the measured values are higher than the modeled, the sign of the result should be positive.	Thank you for noting this. The signs should be reversed with the title. The *2011 ESPR* clarifies the comparison of measured versus modeled results.

Comment #	Author	Topic	Comment	Response
I.11	Nancy S. Timmerman	Noise	On page 6-42, it appears that the airport knows what operation it was that was Stage 2 at night in 2010. Was the operator of that operation prosecuted under the Noise Rules?	The flight was discussed with the operator and the aircraft type was a replacement for another aircraft that was experiencing issues.
I.12	Nancy S. Timmerman	Noise	On page 6-51, you note that the new system has a way to correlate complaints with flight paths. How is this information being used? Do you contact the carriers and/or the FAA?	The new system allows the flight that caused the complaint to be linked for follow up by Massport staff. Yes, carriers and/or FAA are contacted to help resolve the issue.
I.13	Nancy S. Timmerman	Noise	On page 6-54, Northwest's operations in the years prior to merging with Delta should have been reported in Table 6-14, for completeness.	Comment noted and this is being presented in the *2011 ESPR* .
I.14	Nancy S. Timmerman	Noise	In the next Environmental Status and Planning Report (ESPR), Massport and its consultants should provide a discussion of likely speech and sleep interference from the jet arrivals and departures from Boston-Logan International Airport. Time above (TA), which is reported in Tables 6-13 and -14, can be used to get a measure of the problem.	Comment noted. The *2011 ESPR* follows the Secretary's Certificate.

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C

Proposed Scope for the 2012/2013 EDR

PROJECT NAME:	*Logan Airport 2012/2013 Environmental Data Report*
PROJECT LOCATION:	East Boston, Massachusetts
EOEEA NUMBER:	3247
PROJECT PROPONENT:	Massachusetts Port Authority (Massport)

Massport respectfully submits this proposed scope for a combined *Logan Airport 2012/2013 Environmental Data Report (EDR)* for public review and comment. This combined 2012/2013 EDR would follow the *2011 Environmental Status and Planning Report (ESPR),* which was filed in the spring of 2013. Due to the timing of the filings, this *2012/2013 EDR* will be submitted to the Executive Office of Energy and Environmental Affairs (EOEEA) in October 2014. Massport will continue to evaluate the cumulative impacts associated with Logan Airport activities through preparation of an ESPR approximately every five years with data updates annually through the EDRs. Massport will continue to provide interim updates on key environmental topics on the Massport website (http//www.massport.com/environment/pages/default.aspx).

Purpose of the *Logan Airport 2012 /2013 EDR*

The *2012/2013 EDR* will provide an update on conditions at Logan Airport for calendar year 2012 and 2013. The EDR will continue to serve as a background/context against which projects at Logan Airport can be evaluated. It also will report on the cumulative effects of Logan Airport operations and activities, compared to previous years, as appropriate.

The EDR complements the project-specific Environmental Notification Forms (ENFs) and, if necessary, Environmental Impacts Reports (EIRs) to help focus the review processes and to ensure that segmented project review does not occur in the context of Massachusetts Environmental Policy Act (MEPA) review of projects at Logan Airport.

Contents of the *2012/2013 EDR*

Generally, the *2012/2013 EDR* will follow the format of the *2010 EDR*, presenting an overview of the role of Logan Airport in the regional planning context. The *2012/2013 EDR* will report on 2012 and 2013 passenger and aircraft operation activity levels. This will be followed by a status report on Massport's proposed planning initiatives and projects and mitigation. In this way, Massport will provide necessary background information

to allow the reviewer to understand the environmental policies and planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport.

The technical studies in the *2012/2013 EDR* will include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Each chapter's contents are described below.

1. Introduction/Executive Summary

This chapter of the *2012/2013 EDR* will include:

- Overview of Logan Airport and place it in its environmental, geographic, and regulatory context
- Overview of the EDR/ESPR cycle
- Summary of passenger activity levels and operations
- Description of the analysis framework for the environmental reporting and technical studies to be conducted
- Overview of the Logan Airport planning initiatives and projects
- Overview of sustainability initiatives at Logan Airport
- Description of the organization of the *2012/2013 EDR*

2. Activity Levels

A primary purpose of this chapter will be to report on airport activity levels for 2012/2013, including:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport
- Passenger activity levels
- Cargo and mail activities
- Compare 2012 and 2013 aircraft operations, cargo/mail operations, and passenger activity levels to 2011 activity levels
- Report on national aviation trends in 2012/2013 and compare to trends at Logan Airport

3. Airport Planning

Massport continues to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport also must accommodate and guide tenant development. This chapter will describe the status of planning initiatives for the following areas:

- Roadway Corridor Project
- Airport Parking
- Terminal Area
- Airside Area
- Service and Cargo Areas
- Airport Buffers and Landscaping

The status of long-range planning activities also will be provided. The chapter will report on the status of public works projects implemented by other agencies within the boundaries of Logan Airport. The chapter will also report on the status and effectiveness of the ground access related changes including roadway and parking projects, which consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on external streets in adjacent neighborhoods.

4. Regional Transportation

The *2012/2013 EDR* will describe Logan Airport's role in the region's intermodal transportation system by reporting on the following:

Regional Airports

- 2012 and 2013 regional airport operations, passenger activity levels, and schedule data within an historical context
- Status of plans and new improvements as provided by the regional airport authorities
- Ground access improvements to the regional airports
- The role that Worcester Regional Airport and Hanscom Field play in the regional aviation system and Massport's efforts to promote these airports

Regional Transportation System

- Massport's role in managing the regional transportation facilities within the restructured Massachusetts Department of Transportation (MassDOT)
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations
- Report on metropolitan and regional rail initiatives and ridership

5. Ground Access to and from Logan Airport

The chapter will report on 2012 and 2013 conditions and provide a comparison of 2012 and 2013 findings to those of 2011 for the following:

- Detailed description of compliance with Logan Airport Parking Freeze
- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Scheduled, Unscheduled, Water Transportation, and Logan Express)
- Logan Airport Employee Transportation Management Association (Logan TMA) services
- Logan Airport gateway volumes
- On-airport traffic volumes
- On-airport vehicle miles traveled (VMT).
- Parking demand and management (including rates and duration statistics)
- Status of long-range ground access management strategy planning
- Results of the 2013 Logan Airport Passenger Survey

This chapter also will present a discussion of the following topics:

- Definition of HOV
- Massport's target HOV mode share along with incentives
- Non-Airport through-traffic
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line and Silver Line
- Report on Logan Express usage and efforts to increase capacity and usage

- Progress on enhancing water transportation to and from Logan Airport
- Progress on rental car consolidation
- Report on results of ground access study
- Strategies for enhancing services and increasing employee membership in the Logan Airport TMA.

6. Noise Abatement

This chapter will provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter will report on 2012 and 2013 conditions and compare those conditions to those of 2011 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft
- Nighttime operations
- Runway utilization (report on aircraft and airline adherence with runway utilization goals)
- Preferential runway advisory system (PRAS) tracking
- Flight tracks

The chapter will report on 2012 and 2013 conditions and compare those to 2011 conditions for the following noise indicators:

- Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM), and RealContours™ and RealProfiles™, produce an accurate set of Day-Night Sound Level (DNL) noise contours. Adjustments made to account for over-water sound propagation and the propagation of sound to areas of higher terrain will be reported
- Noise-impacted population
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of RealContours™ and RealProfiles™
- Cumulative Noise Index (CNI)
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels
- Installation and benefits of the new noise monitoring system
- Flight track monitoring noise quarterly reports

The chapter will also report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide a status update on the new noise and operations monitoring system.

7. Air Quality/Emissions Reductions

This chapter will begin with an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The chapter will provide discussion on progress on the national and international levels to decrease air emissions to provide context for this chapter. The chapter will also discuss analysis methodologies and assumptions and report on 2012 and 2013 conditions using the most recent versions of the Emissions Dispersion Modeling System (EDMS) and MOBILE motor vehicle emissions. The chapter will include:

- Emissions inventory for carbon monoxide (CO)
- Emissions inventory for oxides of nitrogen (NO_x)
- Emissions inventory for volatile organic compounds (VOCs)
- Emissions inventory for particulate matter (PM)

- Nitrogen dioxide (NO_2) monitoring
- NO_x emissions by airline

This chapter will also report on the following air quality initiatives (AQI) for 2012 and 2013:

- Air Quality Initiative Tracking
- Massport's and Tenant's Alternative Fuel Vehicle Programs
- The status of Logan Airport air quality studies undertaken by Massport or others, as available

This chapter will include an inventory of greenhouse gas (GHG) emissions from Logan Airport in 2012 and 2013. GHG emissions will be quantified for aircraft, ground service equipment (GSE), motor vehicles and stationary sources using emission factors and methodologies outlined in the Greenhouse Gas Emissions Policy and Protocol issued by EOEEA and the Transportation Research Board's *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories* (Airport Cooperative Research Program (ACRP) Report 11, Project 02-06). The results of the 2012 and 2013 GHG emissions inventory will be compared to the 2011 results.

This chapter will also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions.

8. Water Quality/Environmental Compliance and Management

This chapter will report on the 2012/2013 status of:

- National Pollutant Discharge Elimination System (NPDES) Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility
- Jet fuel usage and spills
- Massachusetts Contingency Plan (MCP) Activities
- Tank management
- Update on the environmental management plan
- Fuel spill prevention

The chapter will also present a discussion of the following topics:

- Future stormwater management improvements (if any)
- Future MCP and tank management activities

9. Project Mitigation Tracking

This chapter will report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review and other commitments and have commenced construction. The status of mitigation commitments made in the Section 61 Findings for the following projects will be reported:

- West Garage/Central Garage
- International Gateway
- Runway Ends 22R and 33L Runway Safety Area Improvements
- Replacement Terminal A
- Logan Airside Improvements Planning
- Southwest Service Area Redevelopment Program

This chapter will update the status of Massport's mitigation commitments and also will identify projects for which mitigation is complete.

<u>Appendices</u>
MEPA Documentation
These appendices will include a copy of the Secretary's Certificate and comment letters received on the *2011 ESPR*. Individual responses to items raised in the Secretary's Certificate on the *2011 ESPR* and comments in reviewers' letters will be provided. A distribution list for the *2012/2013 EDR* (indicating those receiving documents or CDs) will be provided. The document will also contain copies of any MEPA Certificates issued for projects at Logan Airport in 2012 and 2013.

Supporting Technical Documentation
Supporting technical appendices will be provided as necessary.

D

Distribution

This *2011 Environmental Status and Planning Report* (*2011 ESPR*) has been distributed to federal, state, and city agencies and to parties listed in this appendix. The list includes those entities that the Massachusetts Environmental Policy Act (MEPA) requires as part of the review of the document, representatives of governmental agencies, commenters on the *2010 EDR*, and community groups concerned with airport activities.

The *2011 ESPR* is also available on Massport's website at www.massport.com and electronically on compact disc (CD). Limited CD or printed copies of the *2011 ESPR* may be requested from Lisa Carisella, Massport, Suite 200S, Logan Office Center, One Harborside Drive, East Boston, MA 02128, telephone (617) 568-3507, e-mail: lcarisella@massport.com. Printed and electronic copies of this report are available for review at the following public libraries:

Table D-1 Libraries

	Library	Address		Library	Address
P,C	Boston Public Library Main Branch	666 Boylston Street Boston, MA 02117	P,C	Boston Public Library Charlestown Branch	179 Main Street Charlestown, MA 02129
P,C	Boston Public Library Connolly Branch	433 Centre Street Jamaica Plain, MA 02130	P,C	Boston Public Library East Boston Branch	276 Meridian Street East Boston, MA 02128
P,C	Boston Public Library Orient Heights Branch	18 Barnes Avenue East Boston, MA 02128	P,C	Boston Public Library South Boston Branch	646 East Broadway South Boston, MA 02127
P,C	Bedford Public Library	7 Mudge Way Bedford, MA 01730	P,C	Cary Memorial Library	1874 Massachusetts Avenue Lexington, MA 02420
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P,C	Lincoln Public Library	3 Bedford Road Lincoln, MA 01773	P,C	Milton Public Library Main Branch	476 Canton Avenue Milton, MA 02186
P,C	Quincy Public Library Thomas Crane Branch	40 Washington Street Quincy, MA 02169	P,C	Revere Public Library	179 Beach Street Revere, MA 02151
P,C	Winthrop Public Library	2 Metcalf Square Winthrop, MA 02151	P,C	State Transportation Library	10 Park Plaza Boston, MA 02116-3973
P,C	Medford Public Library	111 High St. Medford, MA 02155	P,C	Everett Public Library	410 Broadway Everett, MA 02149
P,C	Somerville Public Library	79 Highland Ave. Somerville, MA 02143	P,C	Cambridge Main Library	449 Broadway Cambridge, MA 02138

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Some parties listed in Table D-2 have been provided a hard copy of the document along with a CD of the complete document. A second group of parties have been provided with a CD only.

Table D-2 Distribution

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Table D-2 Distribution (Continued)

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C Senator Sal DiDomenico
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C Speaker of the House Robert A. DeLeo
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C Senator Anthony Petruccelli
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C Representative Kathi-Anne Reinstein
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C Representative William M Straus
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Table D-2 Distribution (Continued)

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- Appendix F – Regional Transportation
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- Appendix J – Water Quality/Environmental Compliance and Management
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- Appendix M – Reduced/Single Engine Taxiing at Logan Airport Memorandum

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E

Activity Levels

This appendix provides detailed tables in support of *Chapter 2, Activity Levels*:

- Table E-1 Logan Airport Historic Air Passenger and Operations Data
- Table E-2 Logan Airport Changes in Domestic Passenger Operations by Carrier
- Table E-3 Logan Airport Changes in International Passenger Operations by Carrier
- Table E-4 Logan Airport Scheduled Passenger Departures by Destination
- Logan Activity Forecast Methodology and Assumptions

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Table E-1 Logan Airport Historic Air Passenger and Operations Data

Year	Operations	Air Passengers	Year	Operations	Air Passengers
1980	258,167	14,722,363	1996	456,226	25,134,826
1981	251,961	14,827,684	1997	482,542	25,567,888
1982	244,468	15,867,722	1998	507,449	26,526,708
1983	288,956	17,848,797	1999	494,816	27,052,078
1984	318,959	19,417,971	2000	487,996	27,726,833
1985	349,518	20,448,424	2001	463,125	24,474,930
1986	363,995	21,862,718	2002	392,079	22,696,141
1987	414,968	23,369,002	2003	373,304	22,791,169
1988	407,479	23,732,959	2004	405,258	26,142,516
1989	388,797	22,272,860	2005	409,066	27,087,905
1990	424,568	22,878,191	2006	406,119	27,725,443
1991	430,403	21,450,143	2007	399,537	28,102,455
1992	474,378	22,723,138	2008	371,604	26,102,651
1993	493,093	23,579,726	2009	345,306	25,512,086
1994	458,623	24,468,178	2010	352,643	27,428,962
1995	466,327	24,192,095	2011	368,987	28,907,938

Table E-2 Logan Airport Changes in Domestic Passenger Operations by Carrier

Airline	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2010-2011 Change	2010-2011 Percent Change
Scheduled Jet Carriers	**233,993**	**208,703**	**179,388**	**162,252**	**193,599**	**190,991**	**199,281**	**198,879**	**189,739**	**184,181**	**203,081**	**209,377**	**6,296**	**3.1%**
AirTran Airlines	3,090	3,168	6,464	8,650	12,618	14,580	19,761	18,685	14,665	13,645	13,672	12,869	(803)	(5.9%)
Alaska Airlines	-	-	543	1,086	1,111	1,088	1,097	1,423	1,969	1,818	1,733	1,757	24.0	1.38%
America West Airlines	5,116	3,675	3,285	3,709	5,922	4,467	4,220	2,874	-	-	-	-	-	-
American Airlines	30,821	34,028	30,765	28,692	32,578	27,712	24,631	23,589	22,827	22,766	21,313	18,943	(2,370)	(11.1%)
American Trans Air	1,448	2,171	1,894	2,200	2,342	2,294	-	-	-	-	-	-	-	-
Continental Airlines	16,894	17,097	14,161	13,603	13,575	13,546	13,972	14,090	13,930	11,823	10,869	11,074	205.0	1.89%
Delta Subtotal	52,954	47,810	41,745	36,034	37,209	36,388	31,880	30,913	28,892	24,349	28,980	25,429	(3,551)	(12.3%)
Delta Air Lines Mainline	*22,031*	*19,181*	*20,874*	*15,866*	*15,279*	*14,317*	*18,472*	*21,799*	*19,977*	*17,170*	*21,926*	*19,633*	*(2293.0)*	*(10.5%)*
Delta Express	*13,746*	*13,497*	*9,952*	*5,233*	-	-	-	-	-	-	-	-	-	-
Delta Shuttle	*17,177*	*15,132*	*10,919*	*9,414*	*10,237*	*9,588*	*9,000*	*9,114*	*8,915*	*7,179*	*7,054*	*5,796*	*(1258.0)*	*(17.8%)*
Delta Song	-	-	-	*5,521*	*11,693*	*12,483*	*4,408*	-	-	-	-	-	-	-
Frontier Airlines	1,052	1,162	796	-	-	-	-	-	-	74	1,094	-	(1094.0)	(100.0%)
Independence Air	-	-	-	-	5,533	4,676	45	-	-	-	-	-	-	-
JetBlue	-	-	-	-	9,080	15,069	31,993	34,933	36,887	38,146	49,981	60,745	10764.0	21.54%
Midway Airlines	4,096	2,850	728	-	-	-	-	-	-	-	-	-	-	-
Midwest Airlines	3,726	3,211	2,872	2,373	2,851	3,570	4,287	4,672	4,070	1,649	1,961	2,786	825.0	42.07%
Northwest Airlines	13,147	12,065	11,172	10,588	11,242	9,685	8,652	8,368	7,931	7,745		-	-	-
Southwest Airlines	-	-	-	-	-	-	-	-	-	2,602	13,727	17,413	3686.0	26.85%
Spirit Airlines	-	-	-	-	-	-	683	1,796	1,902	1,942	3,023	3,054	31.0	1.03%
Sun Country Airlines	723	470	8	-	-	-	-	-	-	254	313	509	196.0	62.62%
Trans World Airlines	6,280	4,246	-	-	-	-	-	-	-	-	-	-	-	-
United Airlines	28,092	25,428	22,184	19,619	20,975	18,304	21,153	20,140	18,568	17,531	16,314	15,351	(963.0)	(5.9%)
US Airways	66,554	51,322	42,771	35,698	38,563	39,612	36,907	37,396	38,098	36,466	36,678	36,421	(257.0)	(0.7%)
Virgin America	-	-	-	-	-	-	-	-	-	3,371	3,394	3,026	(368.0)	(10.8%)
Regional/Commuter Carriers	**160,041**	**167,631**	**137,037**	**134,108**	**130,272**	**137,203**	**130,298**	**124,014**	**112,881**	**107,615**	**94,535**	**89,586**	**(4949.0)**	**(5.2%)**
America West Express	1,267	2,203	2,438	1,332	-	-	-	-	-	-	-	-	-	-
American Airlines Subtotal	-	-	-	235	1,533	-	-	-	-	-	-	-	-	-
Chautauqua Airlines (American Airlines)	-	-	-	*235*	*1,533*	-	-	-	-	-	-	-	-	-
American Eagle Airlines	62,140	58,334	48,077	42,847	42,173	37,394	31,227	23,638	19,561	18,665	15,291	6,669	(8622.0)	(56.4%)
Cape Air	31,026	26,882	25,928	26,728	24,816	25,018	27,278	26,546	33,806	36,670	35,899	35,940	41.0	0.11%
Continental Connection Subtotal	-	-	-	-	-	-	-	-	23	1,289	1,809	1,199	(610.0)	(33.7%)
Colgan Air (Continental Connection)	-	-	-	-	-	-	-	-	*23*	*1,289*	*1,809*	*1,199*	*(610.0)*	*(33.7%)*
Continental Express Subtotal	-	15,220	2,234	4,186	6,256	12,544	8,297	2,843	152	106	529	902	373.0	70.51%
Atlantic SE (Continental Express)	-	-	-	-	-	-	-	-	-	-	-	*134*	*134.0*	-
Chautauqua Airlines (Continental Express)	-	-	-	-	-	-	-	-	*152*	*106*	*529*	*719*	*190.0*	*35.92%*
Commutair (Continental Express)	-	*15,220*	*2,234*	*4,186*	*6,256*	*12,544*	*8,297*	*2,843*	-	-	-	-	-	-
Trans States Airlines (Continental Express)	-	-	-	-	-	-	-	-	-	-	-	*49*	*49*	-

Table E-2 Logan Airport Changes in Domestic Passenger Operations by Carrier

Airline	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2010-2011 Change	2010-2011 Percent Change
Delta Connection Subtotal	15,438	18,222	25,467	30,796	25,454	26,557	28,223	37,750	27,453	21,095	18,445	23,243	4,798	26.0%
ACJet (Delta Connection)	2,258	17,275	22,745	20,201	7,244	-	-	-	-	-	-	-	-	-
Atlantic SE (Delta Connection)	-	-	124	698	362	-	-	182	118	162	943	4,948	4,005	424.7%
Big Sky Airlines (Delta Connection)	-	-	-	-	-	-	-	6,929	173	-	-	-	-	-
Chautauqua Airlines (Delta Connection)	-	-	-	1,000	2,116	1,938	1,882	2,187	2,309	1,811	1,794	2,230	436	24.3%
Comair Airlines (Delta Connection)	520	947	2,598	8,897	15,732	24,619	26,341	27,196	23,130	16,576	10,255	7,857	(2,398)	(23.4%)
Compass Airlines (Delta Connection)	-	-	-	-	-	-	-	-	-	-	1,053	1,577	524	49.8%
Freedom Airlines (Delta Connection)	-	-	-	-	-	-	-	610	1,467	16	-	-	-	-
Mesaba Airlines (Delta Connection)	-	-	-	-	-	-	-	-	-	-	1,078	3,117	2,039	189.1%
Pinnacle Airlines (Delta Connection)	-	-	-	-	-	-	-	-	117	124	1,278	1,507	229	17.9%
Shuttle America (Delta Connection)	-	-	-	-	-	-	-	646	139	2,406	2,044	2,007	(37)	(1.8%)
Trans States Airlines (Delta Connection)	12,660	-	-	-	-	-	-	-	-	-	-	-	-	-
MidAtlantic Express	-	-	-	-	380	-	-	-	-	-	-	-	-	-
Midwest/Republic	-	-	-	-	-	-	-	-	244	1,729	258	-	(258)	(100.0%)
Northwest Airlink Subtotal	-	-	-	-	1,300	5,034	3,912	3,547	3,839	4,601	-	-	-	-
Compass Airlines (Northwest Airlink)	-	-	-	-	-	-	-	-	1,631	2,384	-	-	-	-
Pinnacle Airlines (Northwest Airlink)	-	-	-	-	1,300	5,034	3,912	3,547	2,208	2,217	-	-	-	-
United Express Subtotal	-	-	-	1,038	2,036	3,178	4,416	2,832	1,587	1,618	2,802	2,763	(39)	(1.4%)
ACJet (United Express)	-	-	-	1,038	1,038	-	-	-	-	-	-	-	-	-
Air Wisconsin (United Express)	-	-	-	-	801	1,699	-	-	-	-	-	-	-	-
Atlantic SE (United Express)	-	-	-	-	-	-	-	-	-	-	574	6	(568)	(99.0%)
Chautauqua Airlines (United Express)	-	-	-	-	-	103	-	484	598	642	-	-	-	-
Mesa Airlines (United Express)	-	-	-	-	145	1,376	3,806	2,348	989	797	434	258	(176)	(40.6%)
Shuttle America (United Express)	-	-	-	-	-	-	-	-	-	179	1,561	1,941	380	24.3%
Trans States Airlines (United Express)	-	-	-	-	52	-	610	-	-	-	233	558	325	139.5%
US Airways Express Subtotal	50,170	46,770	32,893	26,946	25,920	27,478	26,945	26,858	26,216	21,842	19,502	18,870	(632)	(3.2%)
Air Wisconsin (US Airways Express)	-	-	-	-	-	174	1,381	7,289	7,551	7,590	6,266	6,499	233	3.7%
Allegheny (US Airways Express)	9,537	13,274	7,728	3,877	1,789	-	-	-	-	-	-	-	-	-
Chautauqua Airlines (US Airways Express)	0	12,493	11,888	8,650	8,899	7,852	8,954	3,117	907	1,597	3	-	(3)	(100.0%)
Colgan Air (US Airways Express)	11,390	17,612	13,277	12,806	11,546	12,583	13,088	14,004	11,906	8,368	9,256	8,302	(954)	(10.3%)
Commutair (US Airways Express)	25,774	-	-	-	-	-	-	-	-	-	-	-	-	-
Mesa Airlines (US Airways Express)	3,469	-	-	564	401	4	16	72	-	-	-	-	-	-
MidAtlantic Express (US Airways Express)	-	-	-	-	-	150	130	40	-	-	-	-	-	-
Piedmont Airlines (US Airways Express)	-	-	-	-	1,529	3,165	2,870	1,496	1,327	1,117	963	1,325	362	37.6%
PSA (US Airways Express)	-	-	-	-	-	526	246	109	2	2	2	5	3	150.0%
Republic (US Airways Express)	-	-	-	-	-	46	260	731	4,523	3,168	3,012	2,739	(273)	(9.1%)
Trans States Airlines (US Airways Express)	-	3,391	-	1,049	1,756	2,978	-	-	-	-	-	-	-	-
												-	-	-
Non-Scheduled Operations (Incl. Charter)	**1,008**	**769**	**609**	**467**	**423**	**325**	**369**	**570**	**582**	**412**	**501**	**507**	**6**	**1.2%**
Total Domestic Operations	**395,042**	**377,103**	**317,034**	**296,827**	**324,294**	**328,519**	**329,948**	**323,463**	**303,202**	**292,208**	**298,117**	**299,470**	**1,353**	**0.5%**

Note: Excludes general aviation and all-cargo operations.
Source: Massport

Table E-3 Logan Airport Changes in International Passenger Operations by Carrier

Airline	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2010-2011 Change	2010-2011 Percent Change
Scheduled Jet Carriers	**27,427**	**29,284**	**26,457**	**26,079**	**26,804**	**24,550**	**22,081**	**22,834**	**22,768**	**22,065**	**20,771**	**22,965**	**2,194**	**10.6%**
Aer Lingus	1,160	1,247	1,120	1,173	1,096	1,016	1,020	1,221	1,347	1,268	1,097	1,130	33	3.0%
Aeromexico	-	-	-	-	649	534	210	131	-	-	-	-	-	-
Air Canada	10,047	10,109	8,982	8,526	6,846	5,782	3,950	3,377	3,215	2,988	3,895	4,125	230	5.9%
Air France	1,046	1,118	1,250	1,306	1,362	1,334	1,207	957	902	911	995	1,013	18	1.8%
Air Jamaica	-	443	617	610	662	349	-	-	-	-	-	-	-	-
Air One	-	-	-	-	-	-	-	-	140	-	-	-	-	-
Alitalia	729	707	724	690	894	986	810	886	667	638	624	604	(20)	(3.2%)
American Airlines	4,657	5,097	5,237	5,415	5,175	4,672	4,824	4,700	4,115	3,167	2,422	2,149	(273)	(11.3%)
Astraeus	-	-	-	-	-	-	-	-	-	-	-	100	100	-
British Airways	2,159	1,944	1,986	2,103	2,080	2,151	2,190	2,160	2,134	2,116	2,082	2,161	79	3.8%
Canadian Airlines	417	-	-	-	-	-	-	-	-	-	-	-	-	-
Delta Air Lines	733	1,345	1,022	724	736	749	851	829	848	781	1,614	3,280	1,666	103.2%
Finnair	-	-	-	-	-	44	49	66	48	47	-	-	-	-
FlyGlobespan	-	-	-	-	-	-	-	225	-	-	-	-	-	-
Iberia Airlines	-	-	-	-	-	-	-	304	466	500	435	445	10	2.3%
Icelandair	726	696	834	882	892	811	807	869	821	777	816	928	112	13.7%
JetBlue	-	-	-	-	-	-	555	1,363	1,839	2,293	2,262	3,165	903	39.9%
Korean Air Lines	314	-	-	-	-	-	-	-	-	-	-	-	-	-
LACSA Airlines	-	-	154	114	14	-	-	-	-	-	-	-	-	-
Lufthansa	1,140	1,090	1,452	1,357	1,526	1,564	1,522	1,515	1,667	1,722	1,657	1,734	77	4.6%
Northwest Airlines	744	729	738	732	730	727	734	1,081	1,438	1,154	61	-	(61)	(1)
Olympic Airways	256	166	-	-	-	-	-	-	-	-	-	-	-	-
Sabena	724	596	-	-	-	-	-	-	-	-	-	-	-	-
SATA International Airlines	-	-	-	-	-	315	334	393	360	372	403	400	(3)	(0)
SWISS International	926	1,152	728	718	714	704	708	727	722	664	720	725	5	0.7%
TACA	-	-	-	220	363	327	236					-	-	-
TACV - Cabo Verde	-	-	-	53	157	154	139	165	154	210	240	236	(4)	(0)
TAP - Air Portugal	200	-	-	-	-	-	-	-	-	-	-	-	-	-
Trans World Airlines	-	1,283	-	-	-	-	-	-	-	-	-	-	-	-
United Airlines	728	840	722	-	-	-	-	-	-	-	-	-	-	-
US Airways	-	-	-	732	2,048	1,607	1,208	1,133	1,155	1,722	667	49	(618)	(1)
VG Airlines	-	-	164	-	-	-	-	-	-	-	-	-	-	-
Virgin Atlantic Airways	721	722	727	724	860	724	727	732	730	735	707	721	14	2.0%
Regional/Commuter Carriers	**15,594**	**14,776**	**11,760**	**10,803**	**11,784**	**13,112**	**12,922**	**15,474**	**12,770**	**11,805**	**12,494**	**12,153**	**(341)**	**(2.7%)**
Air Canada Regional	4,088	2,912	2,850	2,747	5,060	5,120	7,676	8,499	8,478	7,542	7,065	6,803	(262)	(3.7%)
American Eagle Airlines	8,975	8,919	4,545	3,598	3,306	4,637	2,712	3,312	3,311	2,783	2,480	2,206	(274)	(11.0%)
Delta Connection Subtotal	2,531	2,945	4,365	4,458	3,418	3,355	2,534	3,663	981	865	81	1	(80)	(98.8%)
ACJet (Delta Connection)	-	*2,746*	*4,365*	*4,458*	*1,688*	-	-	-	-	-	-	-	-	-
Big Sky Airlines (Delta Connection)	-	-	-	-	-	-	-	*1,468*	-	-	-	-	-	-
Comair Airlines (Delta Connection)	*2,531*	*199*	-	-	*1,730*	*3,355*	*2,534*	*2,195*	*981*	*865*	*81*	*1*	*(80)*	*(1)*
Porter Airlines	-	-	-	-	-	-	-	-	-	615	2,868	3,143	275	9.6%
Non-Scheduled Operations	**2,141**	**1,892**	**1,184**	**1,313**	**1,467**	**1,068**	**727**	**527**	**375**	**320**	**305**	**300**	**(5)**	**(0)**
Total International Operations	**45,162**	**45,952**	**39,401**	**38,195**	**40,055**	**38,643**	**35,730**	**38,835**	**35,913**	**34,198**	**33,570**	**35,418**	**1,848**	**5.5%**

Note: Excludes general aviation and all-cargo operations.
Source: Massport

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2010-2011 Change	2010-2011 Percent Change
Domestic		**210,068**	**203,552**	**160,351**	**148,451**	**165,106**	**163,684**	**164,985**	**163,366**	**152,511**	**146,993**	**149,962**	**152,303**	**2,341**	**1.6%**
New York La Guardia	LGA	11,872	11,608	11,733	13,311	13,709	13,350	12,608	12,579	12,321	11,574	11,705	11,489	(216)	(1.8%)
Washington National	DCA	8,474	9,899	8,198	9,809	10,572	10,680	9,574	9,594	9,267	9,597	9,419	9,793	374	4.0%
Philadelphia	PHL	11,785	10,454	8,947	8,881	8,942	7,014	7,095	6,442	6,986	5,960	6,548	7,985	1,437	22.0%
Chicago O'Hare	ORD	10,063	9,388	8,228	8,019	8,446	7,412	7,244	7,422	7,152	7,092	7,403	7,635	232	3.1%
Baltimore	BWI	1,773	3,278	5,054	5,217	5,281	5,029	6,757	5,820	4,921	4,999	7,053	6,755	(298)	(4.2%)
New York J F Kennedy	JFK	9,899	6,500	5,621	4,435	4,070	4,985	8,832	8,473	7,925	8,103	7,054	5,969	(1,085)	(15.4%)
Atlanta	ATL	7,110	6,471	4,959	4,868	5,194	6,003	5,735	5,777	6,002	6,104	5,548	5,569	21	0.4%
New York Newark	EWR	5,206	8,484	7,244	6,818	5,612	5,626	5,590	4,278	4,004	3,717	3,666	4,608	942	25.7%
Charlotte	CLT	2,758	2,859	2,955	2,872	2,928	3,288	3,168	3,434	3,586	3,703	4,180	3,976	(204)	(4.9%)
Washington Dulles	IAD	8,625	4,486	2,438	2,293	6,201	6,139	6,792	5,417	4,519	4,386	4,625	3,910	(715)	(15.5%)
San Francisco	SFO	3,526	3,298	2,574	2,334	3,083	2,591	2,178	2,619	2,658	3,370	3,711	3,884	173	4.7%
Orlando	MCO	4,914	4,349	3,237	2,050	3,673	3,517	3,077	3,673	3,422	3,094	3,179	3,580	401	12.6%
Nantucket	ACK	5,022	4,646	4,386	3,469	4,406	3,452	3,624	3,501	3,844	3,336	3,884	3,382	(503)	(12.9%)
Pittsburgh	PIT	3,086	3,541	2,944	1,981	2,139	2,021	2,059	2,183	2,471	2,213	2,312	3,179	867	37.5%
Los Angeles	LAX	3,647	3,724	2,862	2,032	3,374	2,655	2,667	2,798	2,295	3,259	3,382	3,164	(218)	(6.5%)
Raleigh/Durham	RDU	3,775	4,622	4,376	3,609	4,106	4,110	4,050	4,322	4,062	4,232	3,259	2,867	(392)	(12.0%)
Martha's Vineyard	MVY	3,863	3,334	2,984	2,667	3,304	2,231	2,614	2,557	2,771	2,670	3,218	2,829	(389)	(12.1%)
Dallas/Fort Worth	DFW	5,002	4,742	4,102	3,817	4,362	3,544	3,442	3,155	3,069	2,917	2,938	2,781	(158)	(5.4%)
Denver	DEN	2,628	2,632	2,289	1,504	2,304	1,990	2,446	2,514	2,092	1,825	2,812	2,640	(172)	(6.1%)
Miami	MIA	2,068	1,864	1,913	2,024	2,183	2,072	2,099	1,946	2,196	2,190	2,238	2,555	317	14.2%
Fort Lauderdale/Hollywood	FLL	3,327	3,049	1,845	1,851	2,691	3,065	2,607	2,610	2,811	1,972	2,370	2,517	147	6.2%
Detroit	DTW	2,937	2,778	2,512	2,664	2,907	2,827	2,887	2,850	2,397	2,322	2,353	2,437	85	3.6%
Buffalo	BUF	950	1,320	1,391	1,282	1,329	1,226	2,101	2,994	2,395	2,327	2,181	2,183	1	0.1%
Albany	ALB	3,433	3,532	1,253	1,084	1,387	1,073	660	1,254	533	711	647	2,180	1,533	236.8%
Provincetown	PVC	2,023	2,054	1,687	1,794	2,169	1,659	2,066	2,277	2,495	1,767	2,410	2,086	(325)	(13.5%)
Minneapolis	MSP	3,078	3,033	2,532	2,238	2,009	1,791	1,696	1,678	1,730	1,878	1,927	2,031	104	5.4%
Milwaukee	MKE	1,189	1,166	1,153	1,350	1,839	2,182	1,668	1,695	1,735	1,889	2,213	1,941	(273)	(12.3%)
Phoenix	PHX	1,386	1,089	944	962	792	944	1,325	1,277	1,072	1,230	1,348	1,895	547	40.6%
Chicago Midway	MDW	868	1,080	975	1,157	1,198	1,339	1,131	1,086	363	834	1,756	1,751	(5)	(0.3%)
Houston Intercontinental	IAH	1,995	2,091	1,734	1,665	1,569	1,752	1,856	1,913	1,809	1,749	1,717	1,697	(20)	(1.2%)
Fort Myers	RSW	949	1,034	778	844	1,064	1,525	1,610	1,693	1,675	1,485	1,587	1,620	33	2.1%
Richmond	RIC	1,537	2,542	1,912	1,856	1,678	1,404	1,557	1,599	1,499	1,387	1,431	1,525	95	6.6%
Lebanon	LEB	-	256	-	-	-	-	-	-	366	2,190	1,734	1,460	(274)	(15.8%)
West Palm Beach	PBI	1,674	1,758	912	1,079	1,348	1,126	1,486	1,479	1,714	1,518	1,450	1,380	(70)	(4.8%)
Cleveland	CLE	2,797	1,699	1,395	1,243	1,263	1,260	1,313	1,387	1,460	1,377	1,369	1,326	(43)	(3.1%)
Cincinnati	CVG	2,235	2,555	2,633	2,591	2,724	2,637	2,012	2,012	2,010	1,876	1,364	1,308	(56)	(4.1%)
Rockland	RKD	1,152	1,164	1,126	1,074	1,360	1,374	1,356	1,268	899	1,279	1,301	1,279	(22)	(1.7%)
Tampa	TPA	2,502	2,128	1,158	1,133	1,743	1,946	1,776	1,819	1,752	1,464	1,246	1,255	9	0.7%
Augusta	AUG	584	591	630	599	392	621	600	617	658	991	1,000	1,187	187	18.8%

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2010-2011 Change	2010-2011 Percent Change
Saranac Lake	SLK	-	-	-	27	275	800	939	544	1,021	1,095	1,174	1,157	(17)	(1.5%)
Rutland	RUT	1,259	1,016	978	930	627	643	626	704	1,098	1,095	1,095	1,148	53	4.9%
Columbus	CMH	2,708	2,958	2,356	2,270	2,083	2,114	1,792	1,828	1,555	1,269	972	1,048	75	7.8%
Hyannis	HYA	2,274	2,041	1,810	1,442	1,852	1,059	995	1,177	966	1,095	1,165	1,047	(118)	(10.1%)
Bar Harbor	BHB	1,196	1,148	1,280	1,220	1,374	1,154	1,179	1,176	1,122	744	815	1,030	215	26.4%
Memphis	MEM	972	1,004	621	365	702	1,034	1,051	1,007	893	984	1,048	1,029	(18)	(1.7%)
Seattle/Tacoma	SEA	458	448	550	989	999	610	914	975	998	927	1,001	993	(9)	(0.9%)
Presque Isle	PQI	1,835	1,714	1,204	1,232	1,028	1,017	1,017	1,004	993	991	991	991	-	0.0%
Indianapolis	IND	765	1,096	1,012	969	1,142	2,076	1,860	1,833	1,821	1,813	1,121	977	(144)	(12.8%)
Syracuse	SYR	3,876	3,424	1,404	1,369	1,337	1,762	1,143	1,121	972	991	991	964	(26)	(2.7%)
Las Vegas	LAS	1,098	844	750	1,109	1,474	1,679	1,761	1,725	1,399	1,060	756	904	148	19.6%
Plattsburgh International	PBG	-	-	-	-	-	-	-	27	969	1,095	1,025	899	(127)	(12.3%)
Rochester	ROC	3,644	2,433	1,242	991	985	1,181	1,563	1,264	1,115	1,109	908	886	(22)	(2.4%)
St. Louis	STL	2,187	2,256	1,825	1,660	1,678	1,461	1,520	1,089	876	857	934	713	(221)	(23.7%)
Harrisburg	MDT	1,307	1,034	991	917	932	886	742	685	728	630	551	574	22	4.0%
Newport News	PHF	-	-	-	-	428	671	949	945	723	660	549	549	-	0.0%
Jacksonville	JAX	-	424	-	-	-	428	721	712	666	348	365	544	179	49.0%
Kansas City	MCI	597	556	304	64	-	241	514	715	637	287	313	536	223	71.2%
San Diego	SAN	366	566	266	330	306	365	365	549	610	592	571	535	(35)	(6.2%)
Norfolk	ORF	838	1,073	1,052	1,039	1,347	1,032	704	647	256	-	-	511	511	-
Akron/Canton	CAK	-	-	-	-	428	730	726	575	458	488	475	488	13	2.8%
Portland	PDX	-	-	-	-	-	-	-	122	366	365	352	440	88	25.0%
Salt Lake City	SLC	1,094	1,095	1,091	846	728	730	708	721	710	704	669	438	(231)	(34.5%)
Austin	AUS	-	171	-	-	-	-	352	365	366	365	365	365	-	0.0%
Myrtle Beach	MYR	105	104	95	118	135	265	267	730	627	457	365	365	-	0.0%
Atlantic City Pomona Field	ACY	-	106	-	134	17	-	-	-	-	245	536	326	(210)	(39.1%)
New Orleans	MSY	-	-	-	61	244	191	-	4	254	339	348	304	(44)	(12.6%)
Long Beach	LGB	-	-	-	-	692	853	840	813	737	647	459	296	(163)	(35.5%)
San Jose	SJC	842	1,034	623	669	406	245	365	365	248		232	292	60	25.8%
Sarasota/Bradenton	SRQ	-	-	-	-	-	30	34	8	26	21	82	242	160	194.3%
Oakland	OAK	-	-	-	-	490	853	813	518	511	488	195	105	(90)	(46.0%)
Allentown/Bethlehem	ABE	780	617	591	150	-	626	777	417	103	-	-	-	-	-
Bangor	BGR	6,644	5,537	4,885	3,706	3,195	2,946	2,529	2,447	1,092	555	-	-	-	-
Binghamton	BGM	-	131	-	-	-	-	-	-	-	-	-	-	-	-
Burlington	BTV	5,913	6,724	2,141	1,582	1,098	1,632	930	452	120	-	-	-	-	-
Charleston	CHS	-	-	-	-	13	61	288	382	178	92	-	-	-	-
Columbia	CAE	-	304	153	90	-	-	-	-	-	-	-	-	-	-
Dayton	DAY	-	-	-	-	-	-	96	270	-	-	-	-	-	-
Elmira/Corning	ELM	441	1,097	78	-	-	-	-	-	-	-	-	-	-	-
Greensboro	GSO	415	995	729	678	1,177	1,120	656	600	178	-	-	-	-	-

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2010-2011 Change	2010-2011 Percent Change
Hartford	BDL	-	360	-	-	-	-	-	-	-	-	-	-	-	-
Islip	ISP	4,222	3,694	1,555	1,056	1,042	1,581	1,190	1,030	649	-	-	-	-	-
Ithaca	ITH	872	790	207	-	-	-	-	-	-	-	-	-	-	-
Louisville	SDF	-	-	-	-	-	-	-	122	86	-	-	-	-	-
Manchester	MHT	-	-	-	-	-	-	-	-	73	-	-	-	-	-
Massena	MSS	-	-	-	-	-	-	-	-	29	-	-	-	-	-
Nashville	BNA	642	1,025	678	-	-	-	319	422	158	-	-	-	-	-
Plattsburgh	PLB	-	-	-	-	-	-	-	26	-	-	-	-	-	-
Portland (ME)	PWM	6,267	5,943	3,953	2,107	1,569	1,394	-	4	-	-	-	-	-	-
Providence	PVD	91	51	-	-	-	-	-	-	-	-	-	-	-	-
Savannah	SAV	-	-	-	-	43	78	279	348	143	-	-	-	-	-
Trenton	TTN	-	-	-	-	-	-	62	943	154	-	-	-	-	-
Watertown	ART	-	-	-	-	-	-	-	707	154	-	-	-	-	-
Westchester County	HPN	6,065	4,379	2,311	1,857	1,908	2,256	2,046	1,233	741	-	-	-	-	-
Wilkes-Barre Scranton	AVP	584	261	-	-	-	420	-	-	-	-	-	-	-	-
International		**23,711**	**24,304**	**20,131**	**19,786**	**19,970**	**19,837**	**18,628**	**20,014**	**18,343**	**17,792**	**18,764**	**19,641**	**877**	**4.7%**
Toronto	YYZ	3,691	4,232	3,761	3,532	3,693	3,876	4,054	4,235	4,218	3,685	3,603	3,737	134	3.7%
London Heathrow	LHR	2,187	2,190	2,395	2,199	2,174	2,133	2,151	2,151	2,126	2,204	2,331	2,833	501	21.5%
Montreal Dorval	YUL	3,401	4,238	3,172	2,946	1,891	2,578	1,835	1,959	2,021	1,863	2,008	2,021	13	0.6%
Toronto Island Apt	YTZ	-	-	-	-	-	-	-	-	-	370	1,535	1,687	151	9.9%
San Juan	SJU	1,750	1,604	1,242	1,351	1,515	1,237	1,290	1,413	1,244	1,024	1,294	1,130	(163)	(12.6%)
Paris De Gaulle	CDG	898	1,004	949	845	868	853	788	671	634	632	710	946	236	33.2%
Halifax	YHZ	3,210	2,385	2,073	2,459	2,271	1,891	1,605	1,622	1,164	1,091	852	744	(108)	(12.7%)
Ottawa	YOW	2,575	2,025	935	907	928	864	875	931	945	878	744	696	(48)	(6.5%)
Amsterdam	AMS	366	365	365	365	366	365	365	549	719	569	457	553	96	21.0%
Frankfurt	FRA	580	579	553	539	563	575	545	549	580	541	548	544	(4)	(0.8%)
Bermuda	BDA	550	549	549	689	580	518	514	685	656	506	532	540	8	1.6%
Reykjavik Keflavik Apt	KEF	393	361	348	344	353	361	361	418	414	396	404	531	127	31.4%
Dublin	DUB	223	279	26	214	113			231	314	313	348	457	109	31.2%
Aruba	AUA	9	182	174	169	274	338	282	304	344	475	407	426	19	4.7%
Zurich	ZRH	523	618	391	353	357	356	361	361	366	335	365	365	-	0.0%
Munich	MUC	-	-	193	235	214	210	214	214	266	335	313	335	22	7.0%
Rome Leonardo Da Vinci-Fi	FCO	-	-	-	-	88	135	79	79	258	326	313	314	0	0.1%
Santo Domingo	SDQ	-	62	136	200	192	174	161	170	87	144	305	275	(30)	(9.8%)
Cancun	CUN	-	44	-	104	305	207	70	209	287	326	307	270	(38)	(12.3%)
Madrid	MAD	-	-	-	-				157	219	248	218	231	13	6.0%
Ponta Delgada	PDL	30	-	-	-	61	39	110	148	127	170	165	170	4	2.7%
Nassau	NAS	-	113	-	-	69	100	428	211	234	185	180	134	(46)	(25.8%)

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2010-2011 Change	2010-2011 Percent Change
Praia	RAI	-	-	-	-	-	9	78	83	74	109	121	122	0	0.4%
Shannon	SNN	366	365	562	374	436	737	795	383	366	339	213	118	(95)	(44.7%)
Saint Thomas	STT	78	199	121	134	104	108	116	99	82	121	125	117	(9)	(6.8%)
Santiago	STI	-	-	-	-	-	-		31				92	92	-
Punta Cana	PUJ	-	-	-	-	-	-	17	13	13	164	95	92	(4)	(4.0%)
Montego Bay	MBJ	-	295	313	291	514	238	39	47	43	103	126	52	(74)	(58.7%)
Saint Maarten	SXM		-	-	-	-	-				61	39	43	4	10.9%
Lisbon	LIS	44	-	-	-	-	-	26	35	31	26	26	26	-	0.0%
Providenciales	PLS	4	22	22	30	43	43	47	39	17	100	39	26	(12)	(31.9%)
Terceira	TER	44	-	-	-	-	-	13	17	17	17	17	17	-	0.0%
Athens	ATH	74	30	-	-	-	-	-	-	-	-	-	-	-	-
Brussels	BRU	362	365	119	-	-	-	-	-	-	-	-	-	-	-
Charlottetown	YYG	-	-	-	-	-	-	-	62	92	83	-	-	-	-
Connaught	NOC	-	-	-	-	-	-	-	44	-	-	-	-	-	-
Fredericton	YFC	-	-	-	306	732	686	365	579	62	-	-	-	-	-
Freeport	FPO	-	-	-	17	-	-	-	-	-	-	-	-	-	-
Gander	YQX	-	-	4	-	-	-	-	-	-	-	-	-	-	-
Glasgow	GLA	-	-	-	-	-	-	-	79	-	-	-	-	-	-
Grand Cayman	GCM	-	-	-	-	-	31	43	13	44	26	17	-	(17)	(100.0%)
Helsinki	HEL	-	-	-	-	-	-	-	-	26	26	-	-	-	-
Ilha Do Sal	SID	-	-	-	13	22	56	-	-	-	-	-	-	-	-
Las Palmas	LPA	-	-	-	-	-	-	-	13	-	-	-	-	-	-
Lerwick Sumburgh Apt	LSI	-	-	-	-	31	-	-	-	-	-	-	-	-	-
London Gatwick	LGW	362	518	147	-	-	-	-	-	-	-	-	-	-	-
Manchester	MAN	26	-	-	-	184	241	244	214	-	-	-	-	-	-
Mexico City	MEX	-	-	-	-	331	234	52	17	-	-	-	-	-	-
Milan Malpensa	MXP	366	365	365	361	362	343	335	361	192	-	-	-	-	-
Nykoping	NYO	-	-	-	-	-	31	-	-	-	-	-	-	-	-
Port Au Prince	PAP	-	-	22	62	56	-	-	-	-	-	-	-	-	-
Puerto Plata	POP	4	17	-	-	-	-	-	-	-	-	-	-	-	-
Quebec	YQB	1,229	935	813	486	-	30	214	579	62	-	-	-	-	-
San Salvador	SAL	-	-	79	165	187	178	130	-	-	-	-	-	-	-
Sao Vicente	VXE	-	-	-	-	-	-	-	-	-	-	4	-	(4)	(100.0%)
Stockholm Arlanda	ARN	-	-	-	-	-	-	26	39	-	-	-	-	-	-
Vancouver	YVR	366	365	304	95	92	62	-	-	-	-	-	-	-	-
Total Scheduled Carrier Operation		**233,779**	**227,856**	**180,482**	**168,237**	**185,076**	**183,520**	**183,612**	**183,380**	**170,854**	**164,784**	**168,726**	**171,945**	**3,219**	**1.9%**

Source: OAG Schedules.

Logan Airport Activity Forecast Methodology and Assumptions

Introduction

The Massachusetts Port Authority (Massport) developed high-level strategic planning forecasts for Logan Airport, Worcester Regional Airport and Hanscom Field in 2011. These forecasts serve as the basis for Massport's airport and ground transportation planning initiatives and analyses of future environmental impacts. The base year for the forecasts was 2010 and the forecast years were 2015, 2020 and 2030. Three forecast scenarios were developed for Logan Airport: Low, Moderate and High. The scope of the strategic planning forecast for Logan Airport included projections of passengers (domestic and international), cargo and aircraft operations (scheduled passenger, all cargo, charter and general aviation [GA]). The Moderate forecast scenario prepared for Logan Airport serves as the basis for the planning, ground traffic and environmental impacts analyses in the *2011 Environmental Status and Planning Report* (*2011 ESPR*). Based on the 2030 Moderate forecast scenario, derivative forecasts were developed to support the air quality, noise, and vehicle miles traveled (VMT) analyses for the *2011 ESPR*. The derivative forecasts include the aircraft fleet mix, average daily operations by aircraft type and stage length, and peak month, busy day, activity.

Summary

The following table is a summary of the 2011 actual and 2030 forecast Logan Airport passengers, cargo, and aircraft operations. Logan Airport's total enplaning plus deplaning passengers are forecast to increase by 1.7 percent annually and to reach 39.8 million in 2030. Logan Airport's domestic cargo is forecast to increase by 2.6 percent annually, slightly faster than the local Massachusetts economy, which is forecast to increase at approximately 2.1 percent per year.

Table E-5 Actual and Forecast Logan Airport Passengers, Cargo, and Aircraft Operations, 2011 and 2030

Category	2011 Actual	2030 Forecast	Average Annual Growth (2011-2030)
Passengers	28,907,938	39,831,471	1.7%
Cargo (pounds)	529,212,783	866,880,603	2.6%
Operations (Passengers)	334,487	438,764	31%
Operations (All-Cargo)	6,270	7,636	21.8%
Operations (GA)	28,230	26,908	(0.3%)

Source: Massport
Note: Numbers in parenthesis () indicate negative number.

Massport Planning Forecasts for Logan Airport

Passengers

The region's economic growth is the primary driver of future air passenger growth at Logan Airport. The Airport serves the seventh largest metropolitan area in the nation. Residents of the Boston metropolitan area have above average incomes and a high propensity for personal and business-related airline travel. Since no airline maintains a connecting hub operation at the Airport, Logan Airport is principally an origin-destination airport. Future passenger levels are therefore largely determined by underlying market demand and are not dependent on airline connecting passengers that transfer from one flight to another.

The price of airline travel, which is inversely related to passenger growth, is another factor that affects passenger demand over the long-term. Real increases in the price of travel airline (i.e., adjusted for inflation) tend to dampen growth in airport passenger levels. Conversely, price reductions may lead to passenger growth as lower prices entice more people to travel. In the current and foreseeable future operating climate, the price of airline travel is strongly linked to fuel prices.

Historically, changes in air service levels and airfares at the closest regional airports, T.F. Green Airport and Manchester-Boston Regional Airport, have also had an impact on traffic levels at Logan Airport. From 1995 to 2002, Logan Airport's share of regional passengers began declining when Southwest Airlines introduced new non-stop services and lower airfares into the T.F. Green and Manchester markets, in 1996 and 1998, respectively. Traffic at Logan Airport grew more slowly than traffic at the regional airports, and Logan Airport's share of the combined three airport market declined from 89 percent in 1995 to 72 percent in 2002. During this period, Logan Airport had very limited services from low-cost carriers (LCCs) and a distinct fare disadvantage in many markets compared to T.F. Green Airport and Manchester-Boston Regional Airport, coupled with the Central Artery/Tunnel project, which hampered Logan Airport's accessibility for many passengers in the region. However, the major portions of Central Artery/Tunnel project were completed in 2004 and LCC services grew rapidly at Logan Airport after the entry of JetBlue Airways in 2004. Following the run-up in fuel prices and the 2008/2009 economic recession, airlines began sharply curtailing services at smaller secondary airports, including T.F. Green Airport and Manchester-Boston Regional Airport. As a result Logan Airport's passenger share climbed from a low of 72 percent to 81 percent in 2011. Over the forecast period, Logan Airport's percent share of the combined passengers at the three airports is assumed to increase slightly over the short-term to approximately 84 percent and then remain stable over the remainder of the forecast period.

The underlying forecast assumptions for long-term economic growth and changes in fuel prices and airline fares are summarized in Table E-6. Total personal income for Massachusetts is assumed to increase at an average annual rate of 2.1 percent (excluding the effects of inflation) through 2030. The price of crude oil, the chief raw input for jet fuel, is forecast to increase to $123 per barrel in 2030, which in turn is assumed to increase the price of airline travel (measured in terms of airline yield, or ticket revenue per passenger mile flown) by 0.5 percent per year (excluding the effects of inflation).

Table E-6 Passenger Forecast Assumptions	
Input	**Assumption**
Massachusetts Personal Income[1]	2.1%
2030 Price of Oil per Barrel[2]	$123
Real Airline Yields[3]	0.5%

Source: ICF SH&E
1 Massachusetts personal income is adjusted for inflation and represents the average annual change 2010 to 2030.
2 In 2009 dollars.
3 Average annual change 2010 to 2030.

Logan Airport's total enplaning plus deplaning passengers are forecast to increase by 1.7 percent annually and to reach 39.8 million in 2030. Domestic passengers are forecast to grow by 1.4 percent per year, while international passengers are forecast to grow at a faster pace of 3.5 percent per year. Although international passenger traffic is forecast to grow more rapidly, domestic passengers represent more than 80 percent of the Airport's forecast passengers in 2030.

Europe, one of Logan Airport's most mature international market segments, is forecast to grow at 2.9 percent per year. Passenger travel to and from Canada, another mature market, is forecast to remain relatively flat over the forecast period. Above average annual growth of 6.1 percent is forecast for the Caribbean market. More than a half million passengers are forecast for Asia and Latin America as a result of projected new nonstop services.

GA passenger traffic, which declined sharply during the 2008/2009 economic recession, and began a robust recovery in 2011, is forecast to remain relatively stable over the forecast period at approximately 108,000 annual passengers.

Table E-7 Actual and Forecast Logan Airport Passengers, Moderate Scenario, 2011 and 2030

Passengers	2011	2030	Average Annual Growth (2011 -2030)
Scheduled/Charter			
Domestic	**24,831,068**	**32,137,828**	**1.4%**
International			
Europe/ Middle East	2,939,226	5,087,299	2.9%
Canada	573,660	568,805	0.0%
Bermuda/ Caribbean	447,650	1,390,216	6.1%
Asia/Pacific	0	409,877	-
Central/South America	1,918	129,769	24.8%
Subtotal International	3,962,454	7,585,965	3.5%
Total Scheduled/Charter	28,793,522	39,723,793	1.7%
General Aviation	**114,416**	**107,678**	**(0.3%)**
Total Passengers	**28,907,938**	**39,831,471**	**1.7%**

Source: Massport
Notes: Massport's forecast planning range is 35.2 million passengers in the Low scenario and 44.4 million passengers in the High scenario.
Numbers in parenthesis () indicate negative number.

Cargo

Cargo shipments handled at Logan Airport consist of heavy freight and express/small packages. The domestic market accounts for three-quarters of the cargo shipments at Logan Airport. Domestic cargo growth is closely tied to local and national economic growth. At Logan Airport, domestic cargo is forecast to increase by 2.6 percent annually, slightly faster than the local Massachusetts economy, which is forecast to increase at approximately 2.1 percent per year. Approximately 83 percent of the domestic cargo at Logan Airport is carried by all-cargo airlines, primarily FedEx and United Parcel Service (UPS). Over the forecast period, the share of Logan Airport's cargo that is carried in all-cargo aircraft is assumed to increase to 86 percent in 2030, consistent with the Federal Aviation Administration's (FAA) assumption that all-cargo airlines will increase their share of the national domestic cargo market over the next twenty years. International cargo, which accounts for 24 percent of Logan Airport's cargo shipments, is primarily carried in the belly compartments of international passenger aircraft and is a key contributor to the profitability of long-haul international passenger services. Future growth in international cargo is assumed to increase in proportion to the growth in international wide-body aircraft capacity at Logan Airport.

The total volume of cargo at Logan Airport is forecast to increase by 2.6 percent per year from 529 million pounds in 2011 to 867 million pounds in 2030. International belly is forecast to grow the fastest at 3.2 percent per year primarily as a result of growth in wide-body belly capacity resulting from new, long-haul services. The Express/All-Cargo segment, which is dominated by FedEx and UPS, is projected to increase by 2.6 percent a year. Domestic belly, the smallest segment of Logan Airport's cargo market, is forecast to increase by just 1.6 percent per year.

Table E-8 Actual and Forecast Logan Airport Express/Freight (in pounds), 2011 and 2030

Type	2011	2030	Average Annual Growth (2011 -2030)
Domestic Belly	63,411,658	85,886,483	1.6%
International Belly	124,703,017	228,401,997	3.2%
Express All-Cargo	341,098,108	552,592,123	2.6%
Total	**529,212,783**	**866,880,603**	**2.6%**

Source: Massport
Note: Massport's forecast planning range is 816 million pounds in the Low scenario and 927 million pounds in the High scenario.

Aircraft Operations

In 2011, Logan Airport accommodated 28.9 million passengers, approximately 4 percent more passengers than in 2000, but with 119,000 fewer aircraft operations. The decline in aircraft operations over the last decade resulted from sharp reductions in the number of small aircraft flights (i.e., turboprops with 19 to 40 seats and regional jets [RJ] with less than 50 seats), increasing aircraft load factors, and fewer GA flights. These factors, however, are not expected to continue over the forecast period. Future declines in small aircraft flights (less than 50 seats) will not be as significant, airline consolidation and high fuel prices will encourage the use of larger aircraft, load factors are high and will only increase slightly, and GA has rebounded from the steep declines resulting from the 2008/2009 economic recession, and is expected to remain stable. (See aircraft fleet forecast section below and Figure E-1 for anticipated changes in the airline fleet mix between 2011 and 2030).

Average load factor and aircraft size assumptions are summarized in Table E-9. The average load factor for the North American market, the dominant market segment at Logan Airport, is assumed to increase slightly from 77 percent in 2011 to 79 percent in 2030. Similarly, average aircraft size for North America is assumed to increase from 104 to 105 seats over the forecast period.

Table E-9 Average Load Factors and Average Aircraft Size, 2011 and 2030				
	Average Load Factors		Average Seats per Operation	
Region	2011	2030	2011	2030
North America	77%	79%	104	105
Europe	78%	82%	252	269
Asia	0%	80%	-	223
Latin America	-	79%	-	154

Source: ICF SH&E

As shown in Table E-10, Logan Airport's total aircraft operations are forecast to increase at an average annual rate of 1.3 percent from 2011 to 2030. Passenger operations with jet aircraft (less than 100 seats) will increase the fastest at 1.8 percent per year. RJ operations will remain relatively flat growing by just 0.3 percent per year. Non-jets will increase by 1.2 percent per year as larger turboprops are added to airline fleets. All-cargo operations are forecast to grow at 1.0 per year, more slowly than the forecast growth in cargo shipments (2.6 percent per year) as a result of cargo airlines sifting their fleets to higher capacity aircraft types. GA is forecast to remain relatively constant with a slight decline of 0.3 percent per year.

Table E-10 Actual and Forecast Logan Airport Aircraft Operations, 2011 and 2030			
Operations	2011	2030	Average Annual Growth (2011 -2030)
Passenger			
Jet[1]	223,083	312,727	1.8%
Regional Jet[2]	61,704	65,480	0.3%
Non-Jet	49,700	61,982	1.2%
Subtotal	334,487	440,189	1.5%
All-Cargo	**6,270**	**7,636**	**1.0%**
General Aviation	**28,230**	**26,908**	**(0.3%)**
Total	**368,987**	**474,734**	**1.3%**

Source: Massport

Notes: Massport's forecast planning range is 418,000 operations in the Low scenario and 533,000 operations in the High scenario. Numbers in parenthesis () indicate negative number.

1 Jets are aircraft with 100 or more seats.

2 Regional jets are aircraft with less than 100 seats.

Derivative Forecasts

Derivative forecasts based on the 2030 strategic planning forecasts were developed to support the air quality, noise and VMT analyses for the *2011 ESPR*. The derivative forecasts include:

- Annual operations by aircraft type (to support air quality modeling);
- Average daily arriving and departing flights by aircraft type and stage length (to support noise modeling); and
- Peak month, busy day, arriving and departing origin-destination passengers by hour (to support VMT modeling).

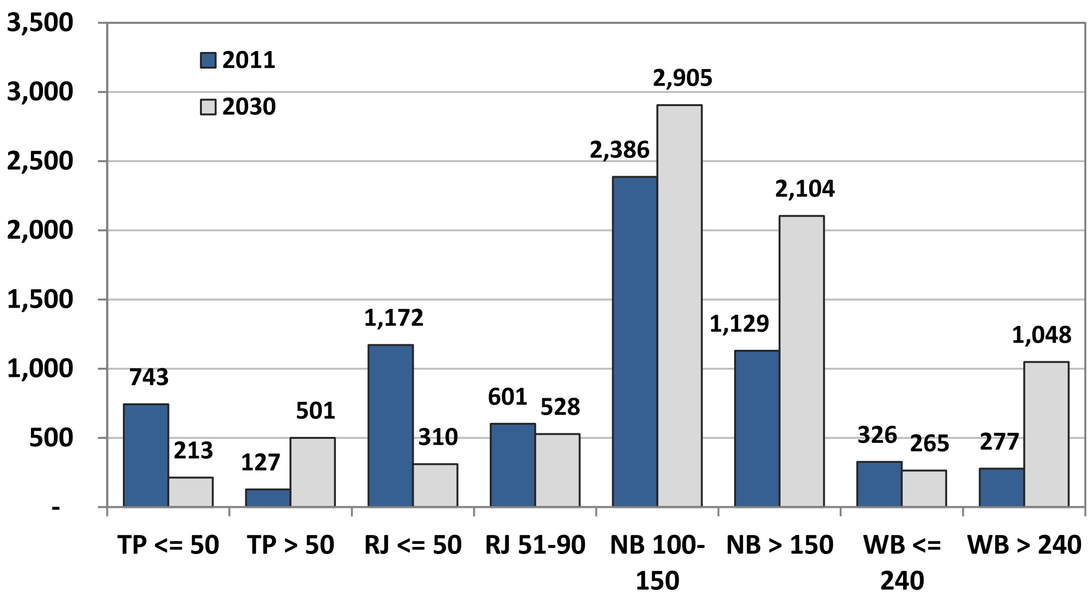
Aircraft Fleet Forecast

The 2030 operations forecast by specific aircraft type is based on anticipated changes in airline aircraft fleets from the ICF SH&E Maintenance Repair Overhaul (MRO) Model. The MRO Model contains a detailed worldwide airline fleet forecast which considers the current airline fleet, projected worldwide passenger and cargo demand, aircraft retirements, aircraft deliveries, conversions of passenger aircraft into all-cargo aircraft, and the introduction of new aircraft models.

Passenger Airlines

The actual 2011 and projected 2030 aircraft fleet mix for North American passenger airlines is shown in Figure E-1. The number of active small turboprops and RJs (less than 50 seats) in the North American fleet is expected to decline significantly from 1,915 aircraft in 2011 to 523 in 2030, as smaller aircraft and RJs continue to fall out of favor under high fuel price conditions. Some of the demand served by these smaller aircraft will be accommodated with larger turboprops (more than 50 seats), which are expected to increase by approximately 374 aircraft by 2030. Large RJs (51 to 90 seats) will fall only slightly from approximately 600 aircraft in 2011 to 528 in 2030. Small narrow-body jets, which account for 35 percent of the 2011 fleet, will increase by approximately 500 aircraft by 2030. The greatest increase in the North America passenger airline fleet will be in larger capacity aircraft, specifically large narrow-bodies (over 150 seats) and large wide-bodies (over 240 seats). The number of large narrow-bodies in the fleet will nearly double from approximately 1,100 in 2011 to 2,100 in 2030. The number of large wide-bodies (over 240 seats) will increase more than threefold from 277 in 2011 to more than 1,000 in 2030. Growth in the large wide-body category will be driven by growth in the long-haul international market, particularly international services at large United States (U.S.) airline connecting hub airports. Similar fleet mix trends are expected for European-based airlines, which dominate the international market at Logan Airport, with significant growth in small and large wide-body aircraft.

Figure E-1 Actual and Forecast North American Passenger Airline Aircraft Fleet, 2011 and 2030



Source: ICF SH&E, MRO Fleet Forecast, 2012 to 2031

Several new aircraft models that will enter the worldwide commercial aircraft fleet are assumed to be introduced into passenger airline service at Logan Airport over the forecast period. The next generation Boeing 737 aircraft, the 737 MAX 7/8/9s, will largely replace the 737-300/400/500s by 2030. Other new narrow-body

types include the Airbus 319 Neo (new engine option), Airbus 320 Neo and Bombardier C-Series 300. New wide-body models that are forecast to enter the Logan Airport fleet include the Boeing Dreamliner (787-8 and 787-9), Boeing 747-800 and Airbus 350. The new Airbus 380, which is classified as a very large aircraft with over 500 seats, is not projected to operate regularly at Logan Airport, although the Airport is classified as a diversion point for aircraft that need to make an emergency landing.

Table E-11 summarizes the existing 2011 and forecast 2030 aircraft fleet mix for scheduled passenger airlines at Logan Airport. Over the forecast period, it is assumed that Cape Air will continue to serve Cape Cod and Massachusetts Island markets, as well as small Essential Air Service markets, from Logan Airport with small piston powered aircraft (9 seats) as this is the ideal size aircraft for serving the seasonal Cape and Island markets and is critical to the carrier's business model. As such, Cape Air's piston operations are assumed to remain relatively constant over the forecast period.

Operations in small turboprops and RJs (with 50 or fewer seats) are forecast to decline, reflecting the decline in the number of small turboprops and regional jets in airline fleets. Overall, the percentage of operations with aircraft having 50 or fewer seats is forecast to decline from 22 percent in 2011 to 14 percent in 2030.

Activity in larger turboprops (over 50 seats) is forecast to increase as airlines add more of these types to their fleets. Increases are also projected for small and large narrow-bodies with a notable shift to large narrow-bodies (over 150 seats). In 2030, the large narrow-body category will account for approximately 20 percent of scheduled airline operations compared to 15 percent in 2011. Increases in wide-body aircraft operations are also projected to support growth in international air travel demand. Strong growth in the small wide-body category (240 or fewer seats), reflects the introduction of the Boeing 787 Dreamliner aircraft which are expected to open up new air services for Logan Airport to markets in Asia and the Middle East. The Dreamliner has an ideal seating capacity and operating capability for serving long-haul markets from Logan Airport.

Table E-11 Scheduled Passenger Airline Operations by Aircraft Category, Actual 2011 and Forecast 2030

Aircraft Category	Actual 2011 Operations	Percent of Total	Forecast 2030 Operations	Percent of Total	Percent Change (2011-2030)
Pistons	35,747	11%	35,989	8%	1%
TP <= 50 Seats	10,053	3%	8,497	2%	(15%)
TP > 50 Seats	4,335	1%	17,495	4%	304%
RJ <= 50 Seats	27,795	8%	17,495	4%	(37%)
RJ > 50 Seats	77,751	23%	47,986	11%	(38%)
NB <= 150 Seats	118,672	35%	199,940	46%	68%
NB > 150 Seats	49,184	15%	87,244	20%	77%
WB <= 240 Seats	2,146	1%	10,155	2%	373%
WB > 240 Seats	8,804	3%	13,963	3%	59%
Total	**334,487**	**100%**	**438,764**	**100%**	**31%**

Source: Massport and ICF SH&E.
Notes: Numbers in parenthesis () indicate negative number.
TP turboprop
RJ regional jet
NB narrow-body
WB wide-body

Cargo Airlines

FedEx and UPS dominate the cargo activity at Logan Airport accounting for three-quarters of all-cargo aircraft operations in 2011. The fleets of all-cargo carriers like FedEx and UPS primarily consist of passenger aircraft that have been retired from service and converted to cargo use. Cargo aircraft currently in use that will be retired over the forecast period include older, fuel inefficient models such as the Boeing 727 (narrow-body jet), DC-9 (narrow-body jet), and DC-10 (wide-body jet). These models will be replaced with models such as the MD-11 (wide-body), Boeing 767 (wide-body), Airbus 300-600 (wide-body) and Boeing 757 (narrow-body). Overall, cargo airlines are expected to move into larger capacity aircraft allowing them to accommodate growth by carrying more cargo per aircraft operation.

These cargo industry trends are reflected in the cargo airline fleet forecast for Logan Airport. While overall cargo demand is forecast to increase at a rate of 2.6 percent per year, all-cargo aircraft operations are forecast to increase at a slower rate of 1.0 percent per year. Table E-12 summarizes the base 2011 and forecast 2030 fleet mix for cargo airlines at Logan Airport.

Table E-12 Cargo Airline Operations by Aircraft Category, Actual 2011 and Forecast 2030

Aircraft Category	Actual 2011 Operations	Percent of Total	Forecast 2030 Operations	Percent of Total	Percent Change (2011-2030)
Narrow-body Jet	1,334	21.3%	2,032	26.6%	52.3%
Wide-body Jet	3,719	59.3%	5,300	69.4%	42.5%
Non-Jet	1,217	19.4%	304	4.0%	(75.0%)
Total	**6,270**	**100.0%**	**7,636**	**100.0%**	**21.8%**

Source: Massport and ICF SH&E.
Notes: Numbers in parenthesis () indicate negative number.

General Aviation

The future fleet mix for general aviation is based the current aircraft types in use at Logan Airport. The general aviation types that accounted for 90 percent of general aviation operations in 2011 were assumed to account for all of the forecast 2030 GA operations.

Table E-13 summarizes the 2030 forecast of Logan Airport operations by user type and aircraft type.

Table E-13 Forecast Logan Airport Operations by Aircraft Type, 2030

Category/ Aircraft Type	2030 Operations	Category/ Aircraft Type	2030 Operations
Scheduled + Charter Passenger Airlines		**Cargo Airlines**	
Airbus A319	35,153	Airbus A300-600	2,466
Airbus A319 Neo	3,999	Boeing 757-200	2,032
Airbus A320	33,523	Boeing 767-300/ER	300
Airbus A320 Neo	33,790	Cessna 208	304
Airbus A321	1,655	McDonnell Douglas MD-11	2,534
Airbus A321 Neo	3,525	**Subtotal**	**7,636**
Airbus A330-200	670		
Airbus A330-300	2,153	**General Aviation**	
Airbus A340-200	268	Beechcraft Beechjet 400	1,735
Airbus A340-300	268	Beechcraft Baron 58	384
Airbus A340-600	268	Beechcraft Bonanza 36	164
Airbus A350-800	1,475	Beechcraft King Air 90	158
Airbus A350-900	1,475	Beechcraft Super King Air 200	389
Boeing 737 MAX 7	11,956	Beechcraft Super King Air 300	194
Boeing 737 MAX 8	36,926	Beechcraft Super King Air 350	258
Boeing 737 MAX 9	7,243	Bombardier Canadair Challenger 600	908
Boeing 737-400	151	Bombardier Canadair Regional Jet 200	382
Boeing 737-700	21,261	Bombardier Challenger 300	858
Boeing 737-700 (Winglets)	5,838	Bombardier Global 5000	136
Boeing 737-800	26,502	Bombardier Global Express	302
Boeing 737-800 (Winglets)	5,333	Cessna Skylane 182	183
Boeing 737-900	5,233	Cessna Caravan 208	609
Boeing 747-400	670	Cessna Chancellor 414	298
Boeing 747-800	536	Cessna Citation Bravo	521
Boeing 757-200	1,003	Cessna Citation CJ3	411
Boeing 757-200 (Winglets)	419	Cessna Citation Excel	2,721
Boeing 767-300	2,480	Cessna Citation III	178
Boeing 767-400	432	Cessna Citation Sovereign	1,204
Boeing 777-300	2,183	Cessna Citation V	941
Boeing 787-8	7,290	Cessna Citation X	1,626
Boeing 787-9	4,021	Cirrus SR-22	342
Bombardier Canadair Regional Jet 200	12,937	Embraer EMB RJ135	177
Bombardier Canadair Regional Jet 700	10,202	Falcon 2000	984
Bombardier Canadair Regional Jet 900	10,288	Falcon 50, Mystère 50	388
Bombardier C Series 300	6,238	Falcon 900, Mystère 900	517
Cessna 402	35,989	Gulfstream IV	1,602
de Havilland DHC-8 Dash 8-100	1,572	Gulfstream V	821
de Havilland DHC-8 Dash 8-300	1,572	Hawker Beechcraft 4000	150
de Havilland DHC-8 Dash 8-400	17,495	IAI Gulfstream G150	213
Embraer 170	6,814	IAI Gulfstream G200	777
Embraer 175	20,682	Learjet 35	423
Embraer 190	48,586	Learjet 40	246
Embraer EMB RJ135	2,493	Learjet 45	530
Embraer EMB RJ145	2,064	Learjet 60	563
McDonnell Douglas MD-80	204	Piaggio P-180 Avanti	689
Saab SF 340A/340B	5,353	Pilatus PC-12 Eagle	1,509
Subtotal	**440,189**	Piper Saratoga	142
		Piper Seneca	134
		Raytheon Hawker 800	2,142
		Subtotal	**26,908**
		Grand Total	**474,734**

Source: ICF SH&E

Operations by Stage Length and Time-of-Day

A forecast of aircraft operations by stage length (the distance traveled by the aircraft) and time-of-day was also developed to support the analysis of noise conditions in 2030. Airline schedules for February (off-peak) and August (peak) of 2012 were analyzed and reviewed to develop assumptions for future scheduled passenger airline operations by aircraft type and stage length. Adjustments were made to account for greater use of large wide-bodies on long-haul domestic routes and the introduction of new long-haul international services by 2030.

Specific assumptions for North American and long-haul international operations are summarized in Tables E-14 and E-15. More than half of forecast North American scheduled passenger operations have stage lengths less than 500 nautical miles. One-quarter of the operations are assumed to have stage lengths of 501 to 1,000 nautical miles and 23 percent are assumed to be over 1,000 nautical miles. Long-haul international operations are dominated by flights to/from Europe; consequently nearly three-quarters of the long-haul international operations have stage lengths of 2,501 to 3,500 nautical miles.

Table E-14 Stage Length Assumptions, North American Scheduled Passenger Airline Operations (2030)

Stage Length (nm)	Pistons	TP <= 50	TP > 50	RJ <= 50	RJ 51-90	NB 100-150	NB> 150	Total	Percent of Total
0 to 500	35,989	8,497	17,495	16,620	31,191	91,973	12,896	214,661	52%
501 to 1000	0	0	0	875	15,355	63,981	21,494	101,705	25%
1001 to 1500	0	0	0	0	1,440	23,993	21,494	46,926	11%
1501 to 2500	0	0	0	0	0	19,994	30,091	50,085	12%
Total	**35,989**	**8,497**	**17,495**	**17,495**	**47,986**	**199,940**	**85,974**	**413,377**	**100%**

Source: ICF SH&E
Notes: North America includes Mexico and the Caribbean.
nm nautical miles
TP Turboprop
RJ Regional jet
NB Narrow-body jet

Table E-15 Stage Length Assumptions, Long-Haul International Scheduled Passenger Airline Operations (2030)

Stage Length (nm)	Narrow-Body > 150	Wide-Body <= 240	Wide-Body > 240	Total	Percent of Total
1501 to 2500	419	1,523	0	1,942	8%
2501 to 3500	850	4,570	13,405	18,825	74%
3501 to 4500	0	1,726	0	1,726	7%
4501 to 5500	0	406	0	406	2%
5501 to 6500	0	1,219	559	1,777	7%
Over 6500	0	711	0	711	3%
Total	**1,269**	**10,155**	**13,963**	**25,388**	**100%**

Source: ICF SH&E
Notes:
nm nautical miles

The distribution of forecast operations by stage length for cargo airlines and passenger charter airlines was based on the distribution of actual activity for 2011 as reported in the U.S. Department of Transportation (U.S. DOT), T-100 database. Specific assumptions for all-cargo and charter airline operations by stage length are summarized in Tables E-16 and E-17.

Table E-16 Stage Length Assumptions, Cargo Airline Operations (2030)					
Stage Length (nm)	Narrow-body Jet	Wide-body Jet	Non-Jet	Total	Percent of Total
0 to 500	532	1,550	304	2,385	31%
501 to 1000	1,501	3,493	0	4,994	65%
1001 to 1500	0	257	0	257	3%
Total	**2,032**	**5,300**	**304**	**7,636**	**100%**

Source: ICF SH&E
Notes:
nm nautical miles

Table E-17 Stage Length Assumptions, Charter Airline Operations (2030)						
Stage Length (nm)	Narrow-Body 100 - 150	Narrow-Body > 150	Wide-Body <= 240	Wide-Body > 240	Total	Percent of Total
0 to 500	332	183	20	0	536	38%
501 to 1000	147	96	2	2	247	17%
1001 to 1500	120	177	2	0	300	21%
1501 to 2500	159	128	14	6	308	22%
2501 to 3500	0	10	8	4	22	2%
4501 to 5500	0	0	0	8	8	1%
5501 to 6500	0	0	0	4	4	0%
Total	**758**	**595**	**47**	**24**	**1,424**	**100%**

Source: ICF SH&E
Notes:
nm nautical miles

Forecasts of activity during the daytime and nighttime periods, where nighttime hours are defined as 10:00 PM to 7:00 AM were also prepared to support the analysis of future noise conditions. Time-of-day assumptions for scheduled passenger airline operations by stage length are based on airline schedules for July 2012. For cargo, charter and GA operations, time-of-day assumptions are based on the actual 2011 time-of-day distribution from the Logan Airport radar data. A summary of the time-of-day assumptions is presented in Table E-18.

Table E-18 Time-of-Day Assumptions by User Category and Stage Length (2030)					
User Category	Stage Length	Arrivals Day	Arrivals Night	Departures Day	Departures Night
Sched Psgr - No America	0 to 500	95.3%	4.7%	92.9%	7.1%
Sched Psgr - No America	501 to 1000	84.9%	15.1%	87.5%	12.5%
Sched Psgr - No America	1001 to 1500	72.3%	27.7%	80.9%	19.1%
Sched Psgr - No America	1501 to 2500	60.1%	39.9%	94.5%	5.5%
Sched Psgr – Long-Haul Int'l	1501 to 2500	100.0%	0.0%	71.4%	28.6%
Sched Psgr – Long-Haul Int'l	2501 to 3500	100.0%	0.0%	78.6%	21.4%
Sched Psgr – Long-Haul Int'l	3501 to 4500	100.0%	0.0%	100.0%	0.0%
Sched Psgr – Long-Haul Int'l	4501 to 5500	100.0%	0.0%	100.0%	0.0%
Sched Psgr – Long-Haul Int'l	5501 to 6500	100.0%	0.0%	100.0%	0.0%
Sched Psgr – Long-Haul Int'l	over 6500	100.0%	0.0%	100.0%	0.0%
Cargo	0 to 500	45.5%	54.5%	45.8%	54.2%
Cargo	501 to 1000	51.4%	48.6%	34.1%	65.9%
Cargo	1001 to 1500	23.6%	76.4%	42.2%	57.8%
Charter	0 to 500	77.4%	22.6%	73.9%	26.1%
Charter	501 to 1000	77.4%	22.6%	73.9%	26.1%
Charter	1001 to 1500	77.4%	22.6%	73.9%	26.1%
Charter	1501 to 2500	77.4%	22.6%	73.9%	26.1%
Charter	2501 to 3500	77.4%	22.6%	73.9%	26.1%
Charter	4501 to 5500	77.4%	22.6%	73.9%	26.1%
Charter	5501 to 6500	77.4%	22.6%	73.9%	26.1%
General Aviation	0 to 500	91.0%	9.0%	91.5%	8.5%

Source: ICF SH&E

Peak Month, Busy Day Hourly Passenger Forecast

A peak passenger forecast was developed to support the analysis of future ground transportation conditions at Logan Airport. The peak passenger forecast reflects a busy weekday of the peak month for Logan Airport passengers. In 2011, the peak month for passenger traffic was July, which accounted for 9.8 percent of annual enplaned and deplaned passengers. In prior years, the peak month for passenger traffic has consistently been either July or August. Since the ground transportation analyses involve passengers traveling to and from the airport by ground modes, the peak passenger forecast is based on 2030 origin-destination, or “local”, passengers and excludes passengers that transfer from one flight to another. Based on the base year analysis of Logan Airport passengers, approximately 94 percent of domestic and 86 percent of international passengers are local passengers. The busy day for total passengers is estimated to be 104.1 percent of the average day based on peak month scheduled airline seats. Busy day domestic passengers are 104.5 percent of the average day and busy day international passengers are 101.9 percent of the average day.

The actual and forecast peak month, busy day local passengers are summarized in Table E-19.

Table E-19 Peak-Month Busy Day Local Passengers, 2011 Base Year, and 2030 Forecast				
	2011 Domestic	2011 International	2030 Domestic	2030 International
Annual Enplaned + Deplaned Passengers \1	24,831,068	3,962,454	32,137,828	7,585,965
Percent Peak Month	9.6%	11.3%	9.6%	11.3%
Peak Month Enplaned + Deplaned Passengers	2,384,320	446,279	3,085,927	854,384
Percent Local	94.1%	86.0%	94.1%	86.0%
Peak Month Local Passengers	2,243,989	383,956	2,904,303	735,070
Peak Month, Average Day Local Passengers	72,387	12,386	93,687	23,712
Busy Day as a Percent of Average Day	104.5%	101.9%	104.5%	101.9%
Peak Month, Busy Day Local Passengers	**75,680**	**12,615**	**97,950**	**24,152**

Source: Massport and ICF SH&E.
Notes: Excludes general aviation passengers, which do not use the airline terminals at Logan Airport.

Forecast busy day passengers were distributed by terminal to assess the effects of forecast passengers on the Airport roadways. The future distribution of passengers by terminal assumes that in 2030 passengers in the domestic airline terminals (A, B and C) will be distributed in proportion to their narrow-body equivalent gate capacity. Terminal A is estimated to have 25 narrow-body equivalent gates based on 22 actual jet gates and seven RJ gates, which are assumed to the equivalent of three narrow-body jet gates. In Terminal B, five former regional jet gates are being reconfigured as narrow-body gates as part of the Terminal B renovation project. When the project in completed there will be 36 narrow-body gates in Terminal B. As shown in Table E-20, Terminal B has the most narrow-body gate capacity at 41 percent of the total narrow-body gate capacity for Terminals A-C. However, in 2011 Terminal B was underutilized; it accommodated only 33 percent of the peak month passengers. In comparison, Terminal C was over utilized at 43 percent of passengers. The forecast assumes that over the long-term passengers in the domestic airline terminals will be balanced in proportion to terminal gate capacity, as shown in Table E-20.

Table E-20 Actual and Assumed Future Distribution of Passengers by Terminal				
Terminal	Narrow-body Equivalent Gates	Percent of Total	2011 Peak Month Passengers	2030 Peak Month Passengers
A	25	28%	24%	28%
B	36	41%	33%	41%
C	27	31%	43%	31%
Total	**88**	**100%**	**100%**	**100%**

Source: ICF SH&E

Actual and forecast local passengers by terminal for the peak month, busy day are summarized in Table E-21. In the 2011 base year, Terminal E accommodated both domestic and international passengers; Southwest Airlines, which only serves domestic markets from Logan Airport, operated from three gates in Terminal E in 2011. The forecast assumes that by 2030 Terminal E will exclusively accommodate international passengers. A small portion of international passengers will continue to be accommodated at Terminals A-C. These include international departures on U.S. flag airlines and arrivals primarily on U.S. airlines from origins with customs and immigration pre-clearance rights[1].

1 Pre clearance markets are Canada, Bermuda, the Bahamas, Aruba and Ireland. At Logan Airport, flights from Canada, Bermuda, the Bahamas and Aruba were accommodated in the domestic airline terminals in 2011, but Aer Lingus flights arriving from Ireland were accommodated in Terminal E.

Table E-21	Peak-Month Busy Day Local Passengers by Terminal, 2011 Actual and 2030 Forecast			
Terminal	**2011 Domestic**	**2011 International**	**2030 Domestic**	**2030 International**
A	16,445	994	27,827	1,794
B	22,694	1,699	40,070	2,583
C	31,384	606	30,053	1,938
E	5,157	9,317	-	17,836
Total Airport	**75,680**	**12,615**	**97,950**	**24,152**

Source: ICF SH&E.

Hourly and peak hour local arriving and departing passengers by terminal are estimated for the base year based on actual passengers by terminal and scheduled airline seat capacity by terminal for July 2011. The hourly distribution of passengers by terminal for 2011 is shown in Table E-22.

Table E-22 Distribution of Terminal Passengers by Hour for a Busy Day of the Peak Month, 2011

	Terminal A		Terminal B		Terminal C		Terminal E		Total Airport		
Hour	**Arrive**	**Depart**	**Arrive**	**Depart**	**Arrive**	**Depart**	**Arrive**	**Depart**	**Arrive**	**Depart**	**Total**
00:00-00:59	1.5%	0.0%	3.0%	0.0%	2.1%	0.0%	2.5%	0.0%	2.3%	0.0%	1.2%
01:00-01:59	0.0%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.1%
02:00-02:59	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
03:00-03:59	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
04:00-04:59	0.0%	0.0%	0.0%	0.8%	1.6%	0.0%	0.0%	0.0%	0.5%	0.2%	0.4%
05:00-05:59	1.2%	2.6%	0.9%	2.4%	1.6%	0.0%	0.0%	0.0%	1.0%	1.3%	1.2%
06:00-06:59	1.4%	11.0%	2.5%	12.6%	3.3%	12.2%	0.0%	7.1%	2.1%	11.3%	6.7%
07:00-07:59	2.5%	6.8%	3.7%	6.1%	5.4%	8.5%	2.5%	3.1%	3.8%	6.6%	5.2%
08:00-08:59	3.6%	5.1%	4.8%	5.7%	4.6%	8.6%	4.6%	4.6%	4.5%	6.4%	5.4%
09:00-09:59	5.0%	5.4%	3.5%	8.8%	6.3%	5.7%	1.3%	3.9%	4.3%	6.3%	5.3%
10:00-10:59	4.3%	5.6%	5.9%	3.0%	4.8%	7.4%	2.5%	1.6%	4.6%	4.9%	4.7%
11:00-11:59	2.9%	2.5%	6.4%	5.4%	4.3%	6.4%	1.3%	3.1%	4.1%	4.7%	4.4%
12:00-12:59	7.9%	4.9%	4.5%	6.9%	4.2%	3.4%	6.4%	3.1%	5.4%	4.7%	5.1%
13:00-13:59	9.0%	5.4%	5.3%	4.1%	2.4%	3.3%	8.9%	2.4%	5.8%	3.9%	4.8%
14:00-14:59	4.1%	8.3%	5.7%	3.3%	6.5%	4.5%	8.5%	2.2%	6.1%	4.7%	5.4%
15:00-15:59	8.8%	4.5%	6.3%	7.3%	4.2%	5.1%	11.6%	6.3%	7.1%	5.8%	6.4%
16:00-16:59	5.7%	6.2%	7.9%	7.5%	6.3%	4.6%	9.0%	1.6%	7.1%	5.3%	6.2%
17:00-17:59	10.3%	8.3%	7.8%	5.3%	6.2%	7.0%	7.6%	10.9%	7.7%	7.3%	7.5%
18:00-18:59	5.1%	15.2%	5.4%	9.1%	9.6%	5.2%	7.0%	10.6%	7.0%	9.4%	8.2%
19:00-19:59	8.2%	4.4%	5.8%	7.7%	6.3%	8.3%	10.4%	12.7%	7.3%	7.9%	7.6%
20:00-20:59	5.2%	0.9%	7.7%	2.1%	5.6%	5.1%	9.0%	7.4%	6.7%	3.6%	5.2%
21:00-21:59	5.7%	1.4%	5.3%	0.8%	2.4%	3.3%	3.1%	12.9%	4.1%	3.5%	3.8%
22:00-22:59	4.7%	1.3%	3.4%	1.0%	6.8%	0.0%	2.5%	6.6%	4.6%	1.6%	3.1%
23:00-23:59	2.9%	0.0%	3.2%	0.0%	5.4%	1.5%	1.3%	0.0%	3.5%	0.5%	2.0%
Peak Pct	**10.3%**	**15.2%**	**7.9%**	**12.6%**	**9.6%**	**12.2%**	**11.6%**	**12.9%**	**7.7%**	**11.3%**	**8.2%**
Peak Hour	**17:00-17:59**	**18:00-18:59**	**16:00-16:59**	**06:00-06:59**	**18:00-18:59**	**06:00-06:59**	**15:00-15:59**	**21:00-21:59**	**17:00-17:59**	**06:00-06:59**	**18:00-18:59**

Source: Massport and ICF SH&E.

For the forecast year, hourly and peak hour passengers are projected based on the forecast of passengers by terminal and assumptions regarding the future hourly distribution of passengers. For Terminals A-C, the hourly distribution is assumed to be the same as the hourly distribution of scheduled airline seat capacity for July 2012. The hourly assumptions for Terminal E are based on schedule airline seat capacity for July 2012, with adjustments to reflect the relocation of domestic services to Terminals A-C, the addition of new international services to Asia and the Middle East, and smoothing of the international peaking pattern overtime as the market matures. Table E-23 summarizes the hourly passenger distribution assumptions by terminal for 2030.

Table E-23 Assumed Distribution of Terminal Passengers by Hour for a Busy Day of the Peak Month, 2030

	Terminals A, B and C		Terminal E	
Hour	Arriving	Departing	Arriving	Departing
00:00-00:59	3.0%	0.0%	0.0%	0.0%
01:00-01:59	0.3%	0.0%	0.0%	0.0%
02:00-02:59	0.0%	0.0%	0.0%	0.0%
03:00-03:59	0.0%	0.0%	0.0%	0.0%
04:00-04:59	0.3%	0.3%	0.0%	0.0%
05:00-05:59	1.2%	2.3%	0.0%	0.0%
06:00-06:59	2.4%	11.0%	0.0%	1.0%
07:00-07:59	4.9%	7.9%	1.7%	0.0%
08:00-08:59	3.6%	5.2%	4.0%	3.9%
09:00-09:59	5.0%	8.1%	0.0%	2.1%
10:00-10:59	5.1%	6.5%	0.8%	0.0%
11:00-11:59	4.0%	3.8%	4.1%	4.8%
12:00-12:59	4.7%	4.8%	10.4%	0.0%
13:00-13:59	6.7%	5.0%	6.3%	4.3%
14:00-14:59	4.4%	4.3%	12.9%	2.8%
15:00-15:59	5.3%	5.6%	10.8%	2.1%
16:00-16:59	6.7%	6.3%	11.1%	7.7%
17:00-17:59	8.8%	6.9%	6.4%	8.1%
18:00-18:59	6.2%	10.1%	7.4%	10.4%
19:00-19:59	5.2%	6.0%	9.6%	15.5%
20:00-20:59	6.5%	3.4%	10.5%	11.9%
21:00-21:59	4.3%	1.3%	3.9%	10.8%
22:00-22:59	6.5%	0.6%	0.0%	14.6%
23:00-23:59	4.8%	0.6%	0.0%	0.0%
Peak Percentage	**8.8%**	**11.0%**	**12.9%**	**15.5%**
Peak Hour	**17:00-17:59**	**06:00-06:59**	**14:00-14:59**	**19:00-19:59**

Source: ICF SH&E and Massport.

Arriving and departing passengers by terminal and by hour for the base year are summarized in Table E-24. In 2011, Terminal C accommodated more than 31,000 local passengers making it the busiest terminal at the Airport. Terminal E was the least busy terminal with approximately 15,000 local passengers in 2011.

Table E-24	Peak Month Busy Day Passenger by Terminal and by Hour, 2011										
	Terminal A		Terminal B		Terminal C		Terminal E		Total		
Hour	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart	Total
00:00-00:59	125	0	373	0	332	0	215	0	1,045	0	1,045
01:00-01:59	0	0	116	0	0	0	0	0	116	0	116
02:00-02:59	0	0	0	0	0	0	0	0	0	0	0
03:00-03:59	0	0	0	0	0	0	0	0	0	0	0
04:00-04:59	0	0	0	96	247	0	0	0	247	96	343
05:00-05:59	106	237	106	308	247	-	-	-	459	545	1,004
06:00-06:59	116	1,021	315	1,611	521	1,932	-	450	953	**5,014**	5,967
07:00-07:59	215	628	464	784	850	1,337	215	199	1,744	2,949	4,693
08:00-08:59	307	477	595	730	721	1,354	392	294	2,015	2,855	4,870
09:00-09:59	428	500	430	1,130	983	907	107	250	1,948	2,788	4,736
10:00-10:59	364	520	736	389	753	1,165	215	100	2,068	2,174	4,242
11:00-11:59	246	234	792	692	673	1,005	107	199	1,818	2,130	3,949
12:00-12:59	674	458	555	879	657	541	545	199	2,431	2,078	4,510
13:00-13:59	764	503	657	528	375	515	759	151	2,555	1,696	4,251
14:00-14:59	348	773	709	426	1,013	703	729	138	2,800	2,041	4,841
16:00-16:59	484	570	985	953	987	724	773	100	3,229	2,348	5,577
17:00-17:59	871	767	964	680	972	1,099	648	695	**3,455**	3,241	6,696
18:00-18:59	430	1,411	671	1,163	1,500	826	603	676	3,203	4,076	**7,279**
19:00-19:59	695	412	714	979	983	1,306	893	810	3,284	3,506	6,790
20:00-20:59	439	84	953	272	883	800	774	470	3,049	1,627	4,676
21:00-21:59	487	129	661	96	381	526	264	822	1,794	1,574	3,367
22:00-22:59	397	125	425	129	1,070	-	215	420	2,107	674	2,782
23:00-23:59	243	-	402	-	843	244	107	-	1,595	244	1,839
Total	8,486	9,269	12,402	12,786	15,644	15,797	8,556	6,374	45,088	44,226	89,314

Source: Massport
Note: Bold indicates airport-wide peak hour passengers

Table E-25 shows 2030 forecast passengers by terminal and by hour for a busy day of the peak month. Terminal B is projected to accommodate nearly 43,000 local passengers, making it the most utilized terminal in the forecast year. In comparison, 32,000 local passengers are forecast to travel through Terminal C. Terminal E remains the least utilized terminal overall with a forecast of approximately 17,000 passengers.

Table E-25	Peak Month Busy Day Passenger by Terminal and by Hour, 2030										
	Terminal A		Terminal B		Terminal C		Terminal E			Total	
Hour	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart	Total
00:00-00:59	436	0	627	0	470	0	0	0	1,533	0	1,533
01:00-01:59	47	0	67	0	50	0	0	0	164	0	164
02:00-02:59	0	0	0	0	0	0	0	0	0	0	0
03:00-03:59	0	0	0	0	0	0	0	0	0	0	0
04:00-04:59	44	39	63	57	47	43	0	0	154	139	293
05:00-05:59	179	345	258	497	193	372	0	0	630	1,214	1,844
06:00-06:59	353	1,670	509	2,404	382	1,803	0	70	1,243	5,948	7,191
07:00-07:59	709	1,192	1,021	1,716	766	1,287	193	0	2,689	4,195	6,883
08:00-08:59	520	795	749	1,145	561	859	445	268	2,275	3,067	5,342
09:00-09:59	718	1,229	1,034	1,770	776	1,327	0	146	2,528	4,473	7,000
10:00-10:59	741	989	1,068	1,424	801	1,068	90	0	2,700	3,480	6,179
11:00-11:59	574	580	827	835	620	626	455	328	2,476	2,370	4,846
12:00-12:59	681	735	981	1,059	736	794	1,140	0	3,539	2,587	6,127
13:00-13:59	969	754	1,396	1,086	1,047	814	694	295	4,106	2,949	7,055
14:00-14:59	636	645	916	929	687	696	1,422	191	3,661	2,461	6,122
15:00-15:59	760	851	1,094	1,226	820	919	1,184	140	3,858	3,136	6,994
16:00-16:59	971	952	1,399	1,370	1,049	1,028	1,224	523	4,643	3,873	8,516
17:00-17:59	1,278	1,046	1,840	1,506	1,380	1,129	709	550	**5,208**	4,231	9,439
18:00-18:59	891	1,537	1,282	2,213	962	1,660	812	710	3,946	**6,119**	**10,066**
19:00-19:59	752	915	1,082	1,317	812	988	1,061	1,058	3,706	4,279	7,985
20:00-20:59	939	520	1,353	749	1,015	562	1,151	811	4,458	2,641	7,099
21:00-21:59	620	192	893	277	669	208	433	740	2,615	1,418	4,032
22:00-22:59	944	97	1,359	140	1,020	105	0	994	3,323	1,336	4,659
23:00-23:59	688	88	991	127	743	95	0	0	2,421	311	2,733
Total	14,450	15,171	20,808	21,846	15,606	16,385	11,011	6,825	61,875	60,227	122,101

Source: Massport and ICF SH&E.
Note: Bold indicates airport-wide peak hour passengers

Conclusion

Passenger demand for services at Logan Airport is forecast to grow at an average annual rate of 1.7 percent per year from 2011 to 2030, slightly slower than local economic growth (2.1 percent per year) reflecting the continuing maturation of the Logan Airport air travel market. Aircraft operations are expected to increase almost as fast as passenger demand, growing at an average annual rate of 1.3 percent. Changes in the airline fleet mix will result in the introduction of new aircraft models such as the next generation Boeing 737 MAX aircraft and the Boeing 787 Dreamliners. A shift in the aircraft fleet mix, with reductions in small regional jets and turboprops (less than 50 seats), increases in larger regional jets and turboprops (> 50 seats), larger seating capacities for the next generation narrow-bodies, faster growth in long-haul international services, and a small increase in average load factor is expected to increase the average passenger throughput from approximately 78 passengers per operation in 2011 to 84 passengers per operation in 2030.

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F

Regional Transportation

This appendix provides detailed tables in support of *Chapter 4, Regional Transportation*:

- Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2011
- Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2011
- Scheduled Passenger Operations by Market and Carrier for New England's Regional Airports
  - Table F-3 Bradley International Airport, Connecticut
  - Table F-4 T.F. Green Airport, Rhode Island
  - Table F-5 Manchester-Boston Regional Airport, New Hampshire
  - Table F-6 Portland International Jetport, Maine
  - Table F-7 Burlington International Airport, Vermont
  - Table F-8 Bangor International Airport, Maine
  - Table F-9 Tweed-New Haven Airport, Connecticut
  - Table F-10 Worcester Regional Airport, Massachusetts
  - Table F-11 Hanscom Field, Massachusetts
  - Table F-12 Portsmouth International Airport, New Hampshire

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Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2011

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan[3]	Total
2000													
Commercial	132,062	103,750	61,506	47,609	45,745	21,446	5,260	4,029	6,104	6,572	434,083	452,763	886,846
General Aviation1	31,863	52,184	45,740	56,571	59,377	34,831	56,200	46,518	31,601	204,512	619,397	35,233	654,630
Military & Other	5,811	2,764	586	2,072	10,241	26,507	328	495	9,973	1,287	60,064	0	60,064
Total	169,736	158,698	107,832	106,252	115,363	82,784	61,788	51,042	47,678	212,371	1,113,544	487,996	1,601,540
2001													
Commercial	128,638	100,606	61,669	47,770	47,261	18,286	4,581	5,631	4,485	6,414	425,341	434,386	859,727
General Aviation1	30,478	45,095	44,358	62,014	61,986	35,230	56,092	45,464	30,148	197,770	608,635	28,739	637,374
Military & Other	5,913	2,635	607	2,259	11,821	26,623	437	917	8,221	1,252	60,685	0	60,685
Total	165,029	148,336	106,634	112,043	121,068	80,139	61,110	52,012	42,854	205,436	1,094,661	463,125	1,557,786
2002													
Commercial	113,194	96,595	62,346	45,899	38,929	24,412	3,827	4,062	5,059	6,603	400,926	366,476	767,402
General Aviation1	27,838	45,473	29,549	57,720	59,679	35,711	62,163	52,277	28,333	210,221	608,964	25,596	634,560
Military & Other	6,085	2,587	376	2,162	12,167	27,297	593	418	8,220	1,424	61,329	0	61,329
Total	147,117	144,655	92,271	105,781	110,775	87,420	66,583	56,757	41,612	218,248	1,071,219	392,072	1,463,291
2003													
Commercial	103,917	84,301	68,184	42,658	38,293	25,626	3,705	868	4,552	2,956	375,060	344,644	719,704
General Aviation1	27,115	42,878	29,552	44,036	50,461	36,706	54,224	55,972	24,866	190,789	556,599	28,660	585,259
Military & Other	4,214	2,496	324	1,449	11,466	32,938	776	378	7,720	1,142	62,903	0	62,903
Total	135,246	129,675	98,060	88,143	100,220	95,270	58,705	57,218	37,138	194,887	994,562	373,304	1,367,866
2004													
Commercial	108,823	83,496	75,360	46,474	41,719	24,970	4,501	0	3,981	4,308	393,632	374,022	767,654
General Aviation1	32,269	34,878	27,438	41,547	54,709	29,884	58,881	61,343	25,962	175,301	542,212	31,236	573,448
Military & Other	4,100	346	749	1,338	12,404	29,676	1,010	530	7,797	1,195	59,145	0	59,145
Total	145,192	118,720	103,547	89,359	108,832	84,530	64,392	61,873	37,740	180,804	994,989	405,258	1,400,247
2005													
Commercial	119,048	88,374	76,342	42,661	43,987	25,976	6,137	2,727	3,197	3,627	412,076	377,830	789,906
General Aviation1	33,341	28,138	26,369	36,191	49,888	30,016	60,893	62,743	25,446	165,424	518,449	31,236	549,685
Military & Other	3,701	241	479	1,405	11,468	24,154	1,063	519	7,669	904	51,603	0	51,603
Total	156,090	116,753	103,190	80,257	105,343	80,146	68,093	65,989	36,312	169,955	982,128	409,066	1,391,194

Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2011

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan[3]	Total
2006													
Commercial	111,341	81,282	67,326	38,663	41,342	23,466	5,177	3,793	3,981	3,057	379,428	374,675	754,103
General Aviation1	34,548	25,510	25,074	35,572	44,471	29,848	51,702	56,770	25,962	167,560	497,017	31,444	528,461
Military & Other	4,348	229	738	1,536	9,299	22,359	1,157	609	7,797	1,433	49,505	0	49,505
Total	150,237	107,021	93,138	75,771	95,112	75,673	58,036	61,172	37,740	172,050	925,950	406,119	1,332,069
2007													
Commercial	107,097	80,525	69,134	41,450	39,928	22,571	4,594	3,162	4,270	3,477	376,208	370,905	747,113
General Aviation1	29,308	22,984	23,959	31,724	47,521	25,542	51,200	61,296	27,000	160,992	481,526	28,632	510,158
Military & Other	5,097	242	644	1,384	9,528	20,949	944	879	8,017	1,438	49,122	0	49,122
Total	141,502	103,751	93,737	74,558	96,977	69,062	56,738	65,337	39,287	165,907	906,856	399,537	1,306,393
2008													
Commercial	98,194	73,096	63,505	40,834	37,832	19,282	4,013	2,553	1,347	104	340,760	347,784	688,544
General Aviation1	22,908	19,470	16,198	31,869	46,391	27,143	44,642	43,763	31,051	164,195	447,630	23,820	471,450
Military & Other	3,637	187	840	974	9,688	20,449	243	886	7,993	1,590	46,487	0	46,487
Total	124,739	92,753	80,543	73,677	93,911	66,874	48,898	47,202	40,391	165,889	834,877	371,604	1,206,481
2009													
Commercial	82,021	62,233	54,336	35,909	31,153	16,485	3,096	2,527	422	0	288,182	333,064	621,246
General Aviation1	19,586	19,438	14,354	25,473	32,872	19,558	37,722	41,700	25,161	148,696	384,560	12,242	396,802
Military & Other	2,726	260	1,163	778	8,628	16,267	486	17	6,851	1,215	38,391	0	38,391
Total	104,333	81,931	69,853	62,160	72,653	52,310	41,304	44,244	32,434	149,911	711,133	345,306	1,056,439
2010													
Commercial	80,418	60,128	53,971	35,035	29,538	16,190	3,201	1,629	1,516	0	281,626	337,961	619,587
General Aviation1	18,759	21,096	13,636	24,776	36,106	20,142	31,884	41,843	25,674	161,942	395,858	14,682	410,540
Military & Other	3,028	347	933	446	4,776	15,525	381	572	7,707	1,795	35,510	0	35,510
Total	102,205	81,571	68,540	60,257	70,420	51,857	35,466	44,044	34,897	163,737	712,994	352,643	1,065,637
2011													
Commercial	86,838	57,194	51,379	35,157	29,166	16,177	3,367	2,017	1,717	750	283,762	340,757	624,519
General Aviation1	16,483	21,774	12,497	21,453	42,562	19,503	33,919	44,050	27,056	160,840	400,137	28,230	428,367
Military & Other	3,630	369	874	533	5,890	13,220	310	634	8,158	1,409	35,027	0	35,027
Total	106,951	79,337	64,750	57,143	77,618	48,900	37,596	46,701	36,931	162,999	718,926	368,987	1,087,913

Source: Massport, Federal Aviation Administration (FAA) Tower Counts, and individual airport records.

Notes:

1 Includes itinerant and local general aviation operations at the regional airports. There are no local (touch-and-go training) operations at Logan Airport.

2 Commercial operations at Hanscom Field include scheduled commercial operations only; other air taxi operations counted as GA.

3 Operations at Logan Airport include international operations.

Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2011

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan[3]	Total
2000 to 2001													
Commercial	(2.59%)	(3.03%)	0.27%	0.34%	3.31%	(14.73%)	(12.91%)	39.76%	(26.52%)	(2.40%)	(2.01%)	(4.06%)	(3.06%)
General Aviation[1]	(4.35%)	(13.58%)	(3.02%)	9.62%	4.39%	1.15%	(0.19%)	(2.27%)	(4.60%)	(3.30%)	(1.74%)	(18.43%)	(2.64%)
Military & Other	1.76%	(4.67%)	3.58%	9.03%	15.43%	0.44%	33.23%	85.25%	(17.57%)	(2.72%)	1.03%	-	1.03%
Total	(2.77%)	(6.53%)	(1.11%)	5.45%	4.95%	(3.20%)	(1.10%)	1.90%	(10.12%)	(3.27%)	(1.70%)	(5.10%)	(2.73%)
2001 Percent of Total	10.59%	9.52%	6.85%	7.19%	7.77%	5.14%	3.92%	3.34%	2.75%	13.19%	70.27%	29.73%	100.00%
2001 to 2002													
Commercial	(12.01%)	(3.99%)	1.10%	(3.92%)	(17.63%)	33.50%	(16.46%)	(27.86%)	12.80%	2.95%	(5.74%)	(15.63%)	(10.74%)
General Aviation[1]	(8.66%)	0.84%	(33.39%)	(6.92%)	(3.72%)	1.37%	10.82%	14.99%	(6.02%)	6.30%	0.05%	(10.94%)	(0.44%)
Military & Other	2.91%	(1.82%)	(38.06%)	(4.29%)	2.93%	2.53%	35.70%	(54.42%)	(0.01%)	13.74%	1.06%	-	1.06%
Total	(10.85%)	(2.48%)	(13.47%)	(5.59%)	(8.50%)	9.09%	8.96%	9.12%	(2.90%)	6.24%	(2.14%)	(15.34%)	(6.07%)
2002 Percent of Total	10.05%	9.89%	6.31%	7.23%	7.57%	5.97%	4.55%	3.88%	2.84%	14.91%	73.21%	26.79%	100.00%
2002 to 2003													
Commercial	(8.20%)	(12.73%)	9.36%	(7.06%)	(1.63%)	4.97%	(3.19%)	(78.63%)	(10.02%)	(55.23%)	(6.45%)	(5.96%)	(6.22%)
General Aviation[1]	(2.60%)	(5.71%)	0.01%	(23.71%)	(15.45%)	2.79%	(12.77%)	7.07%	(12.24%)	(9.24%)	(8.60%)	11.97%	(7.77%)
Military & Other	(30.75%)	(3.52%)	(13.83%)	(32.98%)	(5.76%)	20.67%	30.86%	(9.57%)	(6.08%)	(19.80%)	2.57%	-	2.57%
Total	(8.07%)	(10.36%)	6.27%	(16.67%)	(9.53%)	8.98%	(11.83%)	0.81%	(10.75%)	(10.70%)	(7.16%)	(4.79%)	(6.52%)
2003 Percent of Total	9.89%	9.48%	7.17%	6.44%	7.33%	6.96%	4.29%	4.18%	2.72%	14.25%	72.71%	27.29%	100.00%
2003 to 2004													
Commercial	4.72%	(0.95%)	10.52%	8.95%	8.95%	(2.56%)	21.48%	(100.00%)	(12.54%)	45.74%	4.95%	8.52%	6.66%
General Aviation[1]	19.01%	(18.66%)	(7.15%)	(5.65%)	8.42%	(18.59%)	8.59%	9.60%	4.41%	(8.12%)	(2.58%)	8.99%	(2.02%)
Military & Other	(2.71%)	(86.14%)	131.17%	(7.66%)	8.18%	(9.90%)	30.15%	40.21%	1.00%	4.64%	(5.97%)	-	(5.97%)
Total	7.35%	(8.45%)	5.60%	1.38%	8.59%	(11.27%)	9.69%	8.14%	1.62%	(7.23%)	0.04%	8.56%	2.37%
2004 Percent of Total	10.37%	8.48%	7.39%	6.38%	7.77%	6.04%	4.60%	4.42%	2.70%	12.91%	71.06%	28.94%	100.00%
2004 to 2005													
Commercial	9.40%	5.84%	1.30%	(8.20%)	5.44%	4.03%	36.35%	-	(19.69%)	(15.81%)	4.69%	1.02%	2.90%
General Aviation[1]	3.32%	(19.32%)	(3.90%)	(12.89%)	(8.81%)	0.44%	3.42%	2.28%	(1.99%)	(5.63%)	(4.38%)	0.00%	(4.14%)
Military & Other	(9.73%)	(30.35%)	(36.05%)	5.01%	(7.55%)	(18.61%)	5.25%	(2.08%)	(1.64%)	(24.35%)	(12.75%)	-	(12.75%)
Total	7.51%	(1.66%)	(0.34%)	(10.19%)	(3.21%)	(5.19%)	5.75%	6.65%	(3.78%)	(6.00%)	(1.29%)	0.94%	(0.65%)
2005 Percent of Total	11.22%	8.39%	7.42%	5.77%	7.57%	5.76%	4.89%	4.74%	2.61%	12.22%	70.60%	29.40%	100.00%

Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2010

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan[3]	Total
2005 to 2006													
Commercial	(6.47%)	(8.02%)	(11.81%)	(9.37%)	(6.01%)	(9.66%)	(15.64%)	39.09%	24.52%	(15.72%)	(7.92%)	(0.84%)	(4.53%)
General Aviation[1]	3.62%	(9.34%)	(4.91%)	(1.71%)	(10.86%)	(0.56%)	(15.09%)	(9.52%)	2.03%	1.29%	(4.13%)	0.67%	(3.86%)
Military & Other	17.48%	(4.98%)	54.07%	9.32%	(18.91%)	(7.43%)	8.84%	17.34%	1.67%	58.52%	(4.07%)	-	(4.07%)
Total	(3.75%)	(8.34%)	(9.74%)	(5.59%)	(9.71%)	(5.58%)	(14.77%)	(7.30%)	3.93%	1.23%	(5.72%)	(0.72%)	(4.25%)
2006 Percent of Total	11.28%	8.03%	6.99%	5.69%	7.14%	5.68%	4.36%	4.59%	2.83%	12.92%	69.51%	30.49%	100.00%
2006 to 2007													
Commercial	(3.81%)	(0.93%)	2.69%	7.21%	(3.42%)	(3.81%)	(11.26%)	(16.64%)	7.26%	13.74%	(0.85%)	(1.01%)	(0.93%)
General Aviation[1]	(15.17%)	(9.90%)	(4.45%)	(10.82%)	6.86%	(14.43%)	(0.97%)	7.97%	4.00%	(3.92%)	(3.12%)	(8.94%)	(3.46%)
Military & Other	17.23%	5.68%	(12.74%)	(9.90%)	2.46%	(6.31%)	(18.41%)	44.33%	2.82%	0.35%	(0.77%)	-	(0.77%)
Total	(5.81%)	(3.06%)	0.64%	(1.60%)	1.96%	(8.74%)	(2.24%)	6.81%	4.10%	(3.57%)	(2.06%)	(1.62%)	(1.93%)
2007 Percent of Total	10.83%	7.94%	7.18%	5.71%	7.42%	5.29%	4.34%	5.00%	3.01%	12.70%	69.42%	30.58%	100.00%
2007 to 2008													
Commercial	(8.31%)	(9.23%)	(8.14%)	(1.49%)	(5.25%)	(14.57%)	(12.65%)	(19.26%)	(68.45%)	(97.01%)	(9.42%)	(6.23%)	(7.84%)
General Aviation[1]	(21.84%)	(15.29%)	(32.39%)	0.46%	(2.38%)	6.27%	(12.81%)	(28.60%)	15.00%	1.99%	(7.04%)	(16.81%)	(7.59%)
Military & Other	(28.64%)	(22.73%)	30.43%	(29.62%)	1.68%	(2.39%)	(74.26%)	0.80%	(0.30%)	10.57%	(5.36%)	-	(5.36%)
Total	(11.85%)	(10.60%)	(14.08%)	(1.18%)	(3.16%)	(3.17%)	(13.82%)	(27.76%)	2.81%	(0.01%)	(7.94%)	(6.99%)	(7.65%)
2008 Percent of Total	10.34%	7.69%	6.68%	6.11%	7.78%	5.54%	4.05%	3.91%	3.35%	13.75%	69.20%	30.80%	100.00%
2008 to 2009													
Commercial	(16.47%)	(14.86%)	(14.44%)	(12.06%)	(17.65%)	(14.51%)	(22.85%)	(1.02%)	(68.67%)	(100.00%)	(15.43%)	(4.23%)	(9.77%)
General Aviation[1]	(14.50%)	(0.16%)	(11.38%)	(20.07%)	(29.14%)	(27.94%)	(15.50%)	(4.71%)	(18.97%)	(9.44%)	(14.09%)	(48.61%)	(15.83%)
Military & Other	(25.05%)	39.04%	38.45%	(20.12%)	(10.94%)	(20.45%)	100.00%	(98.08%)	(14.29%)	(23.58%)	(17.42%)	-	(17.42%)
Total	(16.36%)	(11.67%)	(13.27%)	(15.63%)	(22.64%)	(21.78%)	(15.53%)	(6.27%)	(19.70%)	(9.63%)	(14.82%)	(7.08%)	(12.44%)
2009 Percent of Total	9.88%	7.76%	6.61%	5.88%	6.88%	4.95%	3.91%	4.19%	3.07%	14.19%	67.31%	32.69%	100.00%
2009 to 2010													
Commercial	(1.95%)	(3.38%)	(0.67%)	(2.43%)	(5.18%)	(1.79%)	3.39%	(35.54%)	259.24%	-	(2.27%)	1.47%	(0.27%)
General Aviation[1]	(4.22%)	8.53%	(5.00%)	(2.74%)	9.84%	2.99%	(15.48%)	0.34%	2.04%	8.91%	2.94%	19.93%	3.46%
Military & Other	11.08%	33.46%	(19.78%)	(42.67%)	(44.65%)	(4.56%)	(21.60%)	3264.71%	12.49%	47.74%	(7.50%)	-	(7.50%)
Total	(2.04%)	(0.44%)	(1.88%)	(3.06%)	(3.07%)	(0.87%)	(14.13%)	(0.45%)	7.59%	9.22%	0.26%	2.12%	0.87%
2010 Percent of Total	9.59%	7.65%	6.43%	5.65%	6.61%	4.87%	3.33%	4.13%	3.27%	15.37%	66.91%	33.09%	100.00%
2010 to 2011													
Commercial	7.98%	(4.88%)	(4.80%)	0.35%	(1.26%)	(0.08%)	5.19%	23.82%	13.26%	-	0.76%	0.83%	0.80%
General Aviation[1]	(12.13%)	3.21%	(8.35%)	(13.41%)	17.88%	(3.17%)	6.38%	5.27%	5.38%	(0.68%)	1.08%	92.28%	4.34%
Military & Other	19.88%	6.34%	(6.32%)	19.51%	23.32%	(14.85%)	(18.64%)	10.84%	5.85%	(21.50%)	(1.36%)	-	(1.36%)
Total	4.64%	(2.74%)	(5.53%)	(5.17%)	10.22%	(5.70%)	6.01%	6.03%	5.83%	(0.45%)	0.83%	4.63%	2.09%
2011 Percent of Total	9.83%	7.29%	5.95%	5.25%	7.13%	4.49%	3.46%	4.29%	3.39%	14.98%	66.08%	33.92%	100.00%

Source: Massport, Federal Aviation Administration (FAA) Tower Counts, and individual airport records.

Notes:

1 Includes itinerant and local general aviation operations at the regional airports. There are no local (touch-and-go training) operations at Logan Airport.

2 Commercial operations at Hanscom Field include scheduled commercial operations only; other air taxi operations counted as GA.

3 Operations at Logan Airport include international operations.

Table F-3 Scheduled Passenger Operations by Market and Carrier for Bradley International Airport

Departures

Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																	
Alaska	AS	Chicago O'Hare	ORD	30												0	-
America West	HP	Columbus	CMH	149												0	-
America West	HP	Las Vegas	LAS	210	204	65										0	-
America West	HP	Phoenix	PHX	275	304	275	361	366	365	365	61					0	-
American	AA	Chicago O'Hare	ORD	2,139	2,147	2,112	1,756	2,001	1,570	959						0	-
American	AA	Dallas/Fort Worth	DFW	1,343	1,283	1,421	1,147	1,403	1,052	1,082	1,091	1,068	1,043	1,052	1,078	26	2.5%
American	AA	Los Angeles	LAX	214	304											0	-
American	AA	Miami	MIA	366	365	427	426	487	365	365	365	366	365	413	516	103	24.9%
American	AA	New York J F Kennedy	JFK		214											0	-
American	AA	San Juan	SJU	366	471	604	529	366	365	365	365	366	365	365	365	0	0.0%
American	AA	St. Louis	STL		124	1,267	869									0	-
Boston-Maine Airways	E9	Fort Lauderdale/Hollywood	FLL						13							0	-
Continental	CO	Cleveland	CLE	582	387	380	74	127	131	92	131	105	75			0	-
Continental	CO	Houston Intercontinental	IAH	366	295		214	222	313	227	232	119				0	-
Continental	CO	New York Newark	EWR	331	186						4					0	-
Delta	DL	Atlanta	ATL	2,192	2,194	2,331	2,164	2,558	3,098	2,406	2,158	2,152	2,103	2,099	2,094	(4)	(0.2%)
Delta	DL	Boston	BOS	4												0	-
Delta	DL	Cancun	CUN									31	30	35	35	0	0.0%
Delta	DL	Cincinnati	CVG	1,464	1,460	1,447	1,447	1,438	1,373	768	562	663	250			0	-
Delta	DL	Detroit	DTW											1,003	658	(346)	(34.4%)
Delta	DL	Fort Lauderdale/Hollywood	FLL	732	945	1,095	885	702	673	717	669	479	281	237	210	(27)	(11.4%)
Delta	DL	Fort Myers	RSW							31	142	121	121	99	90	(9)	(9.0%)
Delta	DL	Las Vegas	LAS							109				9		(9)	(100.0%)
Delta	DL	Los Angeles	LAX						100	291	287	135		83		(83)	(100.0%)
Delta	DL	Minneapolis	MSP											758	576	(182)	(24.0%)
Delta	DL	New York J F Kennedy	JFK	183												0	-
Delta	DL	Orlando	MCO	1,838	1,702	1,460	1,172	1,023	1,095	890	824	692	558	704	608	(96)	(13.7%)
Delta	DL	Salt Lake City	SLC						27	208						0	-
Delta	DL	Tampa	TPA		582	822	886	662	678	682	660	470	180	252	120	(132)	(52.4%)
Delta	DL	West Palm Beach	PBI	732	945	1,003	556	537	516	365	356	370	160	283	120	(163)	(57.5%)
Frontier Airlines	F9	Denver	DEN								306	209				0	-
jetBlue	B6	Fort Lauderdale/Hollywood	FLL											101	599	499	495.7%
jetBlue	B6	Orlando	MCO											101	730	629	625.9%
jetBlue	B6	San Juan	SJU													0	-
jetBlue	B6	West Palm Beach	PBI													0	-
Laker Airways (Bahamas)	7Z	Freeport	FPO	39	78	43	43	26								0	-
Midway Airlines	JI	Raleigh/Durham	RDU	683	391											0	-
Midwest/Republic	YX	Milwaukee	MKE	619	504	420										0	-
Northwest	NW	Amsterdam	AMS								184	274				0	-
Northwest	NW	Detroit	DTW	1,699	1,638	1,487	1,597	1,504	1,451	1,399	1,374	1,189	960			0	-
Northwest	NW	Fort Myers	RSW													0	-
Northwest	NW	Minneapolis	MSP	1,177	1,148	1,099	1,116	1,098	1,042	1,060	1,060	1,002	654			0	-
Northwest	NW	Orlando	MCO										115			0	-
Northwest	NW	Tampa	TPA										261			0	-
Northwest	NW	West Palm Beach	PBI										205			0	-
Southwest	WN	Baltimore	BWI	2,841	2,755	2,689	3,072	3,059	3,094	3,116	3,137	2,883	2,713	2,700	2,708	8	0.3%
Southwest	WN	Chicago Midway	MDW	723	700	708	687	710	953	1,034	1,061	1,033	940	923	979	57	6.1%
Southwest	WN	Denver	DEN											306	365	59	19.3%
Southwest	WN	Fort Lauderdale/Hollywood	FLL				35							70	365	295	423.6%
Southwest	WN	Fort Myers	RSW													0	-
Southwest	WN	Las Vegas	LAS	52	52	22	122	375	365	365	365	366	365	361	365	4	1.2%
Southwest	WN	Nashville	BNA	672	730	674	586	366	365	365	365	366	365	361	304	(57)	(15.7%)
Southwest	WN	Orlando	MCO	375	448	726	730	833	1,108	1,108	1,091	1,081	1,047	1,016	1,003	(13)	(1.3%)
Southwest	WN	Philadelphia	PHL					296	1,590	1,078	169					0	-
Southwest	WN	Tampa	TPA		78	365	365	383	695	730	730	736	426	570	656	86	15.0%
Southwest	WN	West Palm Beach	PBI												61	61	-
Sunworld International	SM	Philadelphia	PHL			153										0	-
Trans World Airlines	TW	Portland (ME)	PWM	305												0	-
Trans World Airlines	TW	St. Louis	STL	1,460	1,336											0	-
United	UA	Chicago O'Hare	ORD	2,034	1,751	2,122	2,185	2,065	1,812	1,816	1,800	1,643	1,364	1,296	1,077	(219)	(16.9%)
United	UA	Denver	DEN	366	304	13										0	-
United	UA	San Francisco	SFO	366	243											0	-
United	UA	Washington Dulles	IAD	1,455	1,155	365	365	492	726	944	1,112	1,076	1,008	1,192	812	(380)	(31.9%)
US Airways	US	Baltimore	BWI	488	1,305											0	-
US Airways	US	Charlotte	CLT	1,464	1,521	1,681	1,349	1,574	2,188	1,660	1,525	1,412	1,104	1,588	1,664	76	4.8%
US Airways	US	Fort Lauderdale/Hollywood	FLL	366	239			9	123							0	-
US Airways	US	Orlando	MCO	1,098	663			48	30	30						0	-
US Airways	US	Philadelphia	PHL	2,148	2,107	1,825	1,781	1,913	2,102	930	665	518	583	361	317	(43)	(12.0%)
US Airways	US	Phoenix	PHX								241	335				0	-
US Airways	US	Pittsburgh	PIT	1,800	1,825	1,729	1,399	1,198	27							0	-
US Airways	US	Washington Dulles	IAD	732												0	-
US Airways	US	Washington National	DCA	1,329	1,142	1,091	1,077	1,081	1,064	947	1,092	1,203	755	361	365	4	1.2%
US Airways	US	West Palm Beach	PBI	366	225											0	-
USA 3000 Airlines	U5	Cancun	CUN						26	30	21					0	-
USA 3000 Airlines	U5	Punta Cana	PUJ						13	22	17					0	-
Subtotal				38,171	36,450	31,921	28,996	28,921	30,507	26,558	24,223	22,463	18,396	18,695	18,841	146	0.8%

Departing Seats

Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																	
Alaska	AS	Chicago O'Hare	ORD	4,050												0	-
America West	HP	Columbus	CMH	18,441												0	-
America West	HP	Las Vegas	LAS	27,469	30,255	9,683										0	-
America West	HP	Phoenix	PHX	37,772	44,992	40,700	53,365	51,960	54,570	54,750	7,564					0	-
American	AA	Chicago O'Hare	ORD	304,855	291,219	279,895	232,333	265,113	203,929	123,729						0	-
American	AA	Dallas/Fort Worth	DFW	185,922	165,562	183,272	148,000	180,987	136,897	144,171	154,505	158,001	154,343	160,983	172,457	11,474	7.1%
American	AA	Los Angeles	LAX	31,244	44,384											0	-
American	AA	Miami	MIA	51,427	53,290	62,342	62,196	71,102	49,990	52,732	51,720	54,168	54,020	63,559	82,560	19,001	29.9%
American	AA	New York J F Kennedy	JFK		31,244											0	-
American	AA	San Juan	SJU	69,348	79,653	103,144	90,017	92,171	84,425	81,776	70,856	65,880	56,900	55,856	58,400	2,544	4.6%
American	AA	St. Louis	STL		17,608	163,480	112,046									0	-
Boston-Maine Airways	E9	Fort Lauderdale/Hollywood	FLL						1,993							0	-
Continental	CO	Cleveland	CLE	68,974	45,629	47,331	11,417	15,985	16,262	9,875	16,262	12,807	9,203			0	-
Continental	CO	Houston Intercontinental	IAH	45,790	37,089		24,483	25,341	34,072	26,618	26,393	13,650				0	-
Continental	CO	New York Newark	EWR	38,916	21,712						446					0	-
Delta	DL	Atlanta	ATL	392,835	400,879	452,378	395,332	450,671	479,098	347,090	326,949	328,814	300,052	300,185	310,149	9,965	3.3%
Delta	DL	Boston	BOS	634												0	-
Delta	DL	Cancun	CUN									5,136	4,543	5,470	5,397	(73)	(1.3%)
Delta	DL	Cincinnati	CVG	244,837	250,529	246,514	264,450	257,177	196,741	102,635	82,000	97,102	37,709			0	-
Delta	DL	Detroit	DTW											129,228	91,657	(37,572)	(29.1%)
Delta	DL	Fort Lauderdale/Hollywood	FLL	87,108	112,455	130,305	122,463	139,613	133,927	127,218	97,327	70,389	39,902	33,674	29,280	(4,394)	(13.0%)
Delta	DL	Fort Myers	RSW							4,402	20,184	17,182	17,369	13,104	12,780	(324)	(2.5%)
Delta	DL	Las Vegas	LAS							16,329				1,394		(1,394)	(100.0%)
Delta	DL	Los Angeles	LAX						19,928	48,428	43,093	20,601		13,257		(13,257)	(100.0%)
Delta	DL	Minneapolis	MSP											99,431	79,418	(20,013)	(20.1%)
Delta	DL	New York J F Kennedy	JFK	39,894												0	-
Delta	DL	Orlando	MCO	218,705	202,538	173,740	165,251	203,634	217,905	160,415	118,320	106,599	79,256	99,129	88,041	(11,088)	(11.2%)
Delta	DL	Salt Lake City	SLC						3,986	31,243						0	-
Delta	DL	Tampa	TPA		69,258	97,818	123,897	131,795	134,894	117,960	93,781	66,811	25,828	33,625	15,420	(18,205)	(54.1%)
Delta	DL	West Palm Beach	PBI	87,108	112,455	119,357	75,907	106,806	102,684	62,395	51,099	53,971	22,659	37,536	16,500	(21,036)	(56.0%)
Frontier Airlines	F9	Denver	DEN								40,392	27,645				0	-
jetBlue	B6	Fort Lauderdale/Hollywood	FLL											15,086	90,231	75,146	498.1%
jetBlue	B6	Orlando	MCO											15,086	109,860	94,774	628.2%
jetBlue	B6	San Juan	SJU													0	-
jetBlue	B6	West Palm Beach	PBI													0	-
Laker Airways (Bahamas)	7Z	Freeport	FPO	5,850	11,700	6,471	6,471	3,900								0	-
Midway Airlines	JI	Raleigh/Durham	RDU	69,213	45,802											0	-
Midwest/Republic	YX	Milwaukee	MKE	44,455	36,082	29,366										0	-
Northwest	NW	Amsterdam	AMS								29,440	43,840				0	-
Northwest	NW	Detroit	DTW	215,750	199,154	190,874	193,856	204,604	192,679	181,501	178,364	152,492	113,746			0	-
Northwest	NW	Fort Myers	RSW													0	-
Northwest	NW	Minneapolis	MSP	135,570	137,404	134,201	144,001	149,646	140,194	147,350	142,982	130,019	84,739			0	-
Northwest	NW	Orlando	MCO										14,278			0	-
Northwest	NW	Tampa	TPA										32,382			0	-
Northwest	NW	West Palm Beach	PBI										25,473			0	-
Southwest	WN	Baltimore	BWI	389,158	377,285	367,798	420,903	419,083	423,878	426,399	429,393	394,440	371,357	367,534	367,414	(120)	(0.0%)
Southwest	WN	Chicago Midway	MDW	99,090	95,861	97,016	93,838	97,309	130,541	141,717	145,318	140,567	128,780	126,412	133,267	6,855	5.4%
Southwest	WN	Denver	DEN											41,922	50,005	8,083	19.3%
Southwest	WN	Fort Lauderdale/Hollywood	FLL				4,756							9,551	50,005	40,454	423.6%
Southwest	WN	Fort Myers	RSW													0	-
Southwest	WN	Las Vegas	LAS	7,163	7,144	2,955	16,714	51,336	50,005	50,005	50,005	50,142	50,005	49,398	50,005	607	1.2%
Southwest	WN	Nashville	BNA	92,064	100,010	92,299	80,341	50,142	50,005	50,005	50,005	49,810	50,005	49,398	41,648	(7,750)	(15.7%)
Southwest	WN	Orlando	MCO	51,336	61,317	99,403	100,010	114,082	151,816	151,816	148,887	148,058	143,459	139,212	137,411	(1,801)	(1.3%)
Southwest	WN	Philadelphia	PHL					40,591	217,850	147,666	23,094					0	-
Southwest	WN	Tampa	TPA		10,706	50,005	50,005	52,530	95,156	100,010	99,366	100,871	58,362	78,129	89,852	11,723	15.0%
Southwest	WN	West Palm Beach	PBI												8,357	8,357	-
Sunworld International	SM	Philadelphia	PHL			22,886										0	-
Trans World Airlines	TW	Portland (ME)	PWM	43,310												0	-
Trans World Airlines	TW	St. Louis	STL	206,109	185,855											0	-
United	UA	Chicago O'Hare	ORD	299,522	262,838	302,260	310,554	317,682	259,437	254,198	259,509	237,995	200,920	198,709	159,738	(38,971)	(19.6%)
United	UA	Denver	DEN	46,901	39,381	1,630										0	-
United	UA	San Francisco	SFO	45,384	33,018											0	-
United	UA	Washington Dulles	IAD	173,869	143,374	46,815	44,087	63,854	81,631	111,596	133,741	131,169	131,883	155,750	108,500	(47,250)	(30.3%)
US Airways	US	Baltimore	BWI	41,760	149,554											0	-
US Airways	US	Charlotte	CLT	214,719	235,997	260,958	191,931	229,826	350,776	227,845	219,915	192,821	146,512	228,119	238,508	10,389	4.6%
US Airways	US	Fort Lauderdale/Hollywood	FLL	39,232	26,818			1,272	15,161							0	-
US Airways	US	Orlando	MCO	117,696	74,184			5,986	3,842	3,737						0	-
US Airways	US	Philadelphia	PHL	310,118	318,428	277,118	253,658	267,741	301,242	139,939	84,575	61,974	58,153	49,914	44,595	(5,319)	(10.7%)
US Airways	US	Phoenix	PHX								28,869	40,200				0	-
US Airways	US	Pittsburgh	PIT	278,575	270,919	255,327	205,951	157,633	3,189							0	-
US Airways	US	Washington Dulles	IAD	86,376												0	-
US Airways	US	Washington National	DCA	171,891	146,558	139,812	138,468	141,901	141,068	130,161	143,281	141,492	84,917	51,434	52,210	776	1.5%
US Airways	US	West Palm Beach	PBI	39,232	25,268											0	-
USA 3000 Airlines	U5	Cancun	CUN						4,336	5,088	3,600					0	-
USA 3000 Airlines	U5	Punta Cana	PUJ						2,128	3,624	2,880					0	-
Subtotal				5,179,671	5,005,409	4,487,153	4,136,700	4,361,471	4,486,236	3,784,422	3,374,113	3,114,646	2,496,754	2,622,086	2,693,666	71,580	2.7%

Table F-3 Scheduled Passenger Operations by Market and Carrier for Bradley International Airport

Departures

Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Regional/Commuter Carriers																	
Air Canada Express	AC	Montreal Dorval	YUL	1,385	1,360	1,343	1,437	1,037	1,038	1,021	1,043	1,024	1,008	1,021	986	(35)	(3.4%)
Air Canada Express	AC	Toronto	YYZ	1,589	1,574	1,446	1,444	1,338	1,342	1,282	1,277	1,241	1,286	1,287	1,308	21	1.6%
America West Express	HP	Columbus	CMH	450	1,104	1,356	500									0	-
American Connection	AA	St. Louis	STL				113	880	947	896	958	827	210			0	-
American Eagle	AA	Chicago O'Hare	ORD					9		701	1,825	1,297	1,034	1,501	1,630	129	8.6%
American Eagle	AA	New York J F Kennedy	JFK	1,460	1,185	1,005	240									0	-
American Eagle	AA	Raleigh/Durham	RDU		197	1,128	1,038	1,233	1,364	1,370	1,185	1,155	1,043	257		(257)	(100.0%)
American Eagle	AA	St. Louis	STL										92			0	-
Continental Connection	CO	Albany	ALB			148	626	860	51							0	-
Continental Connection	CO	Binghamton	BGM		156											0	-
Continental Connection	CO	Boston	BOS		434											0	-
Continental Connection	CO	Buffalo	BUF	89	582											0	-
Continental Connection	CO	Burlington	BTV	4	154											0	-
Continental Connection	CO	New York J F Kennedy	JFK		235											0	-
Continental Connection	CO	New York Newark	EWR									672	375	608	901	294	48.3%
Continental Connection	CO	Philadelphia	PHL		566											0	-
Continental Connection	CO	Rochester	ROC	93	569											0	-
Continental Connection	CO	Syracuse	SYR	97	445											0	-
Continental Express	CO	Cleveland	CLE	803	1,064	971	1,121	1,124	1,102	1,159	1,151	1,145	1,164	1,208	1,200	(8)	(0.7%)
Continental Express	CO	New York Newark	EWR	1,747	1,685	1,591	1,382	1,368	1,351	1,364	1,386	696	841	465	258	(208)	(44.6%)
Delta Connection	DL	Atlanta	ATL							83		4			48	48	-
Delta Connection	DL	Cincinnati	CVG							623	798	714	1,088	1,218	1,251	33	2.7%
Delta Connection	DL	Columbus	CMH					93	994	621	595	191				0	-
Delta Connection	DL	Detroit	DTW											1,004	1,323	319	31.8%
Delta Connection	DL	Fort Lauderdale/Hollywood	FLL									53				0	-
Delta Connection	DL	Fort Myers	RSW						612	359		4				0	-
Delta Connection	DL	Minneapolis	MSP											481	814	333	69.2%
Delta Connection	DL	Myrtle Beach	MYR	61												0	-
Delta Connection	DL	New York J F Kennedy	JFK							546	1,177	1,050	795	365	304	(61)	(16.7%)
Delta Connection	DL	Orlando	MCO							88						0	-
Delta Connection	DL	Raleigh/Durham	RDU											100	569	469	467.9%
Delta Connection	DL	Tampa	TPA									79				0	-
Delta Connection	DL	Washington National	DCA											166	929	764	461.3%
Delta Connection	DL	West Palm Beach	PBI									8				0	-
Frontier Express	F9	Milwaukee	MKE											140	417	276	196.9%
Independence Air	DH	Washington Dulles	IAD					1,154	1,966	93						0	-
Midway Airlines	JI	Raleigh/Durham	RDU	1,348	1,065											0	-
Midwest Connect	YX	Milwaukee	MKE	4	144	271	896	941	965	943	831	532				0	-
Northwest Airlink	NW	Detroit	DTW							95	330	523	804			0	-
Northwest Airlink	NW	Indianapolis	IND					113	638	625	608	610	77			0	-
Northwest Airlink	NW	Memphis	MEM									53				0	-
Northwest Airlink	NW	Minneapolis	MSP						31			57	459			0	-
Shuttle America	S5	Albany	ALB	66												0	-
Shuttle America	S5	Bedford	BED	233	34											0	-
Shuttle America	S5	Buffalo	BUF	337												0	-
Shuttle America	S5	Islip	ISP	27												0	-
Shuttle America	S5	Wilmington	ILG	159												0	-
Swissair	SR	New York J F Kennedy	JFK	31												0	-
Trans World Airlines	TW	New York J F Kennedy	JFK	1,098												0	-
United Express	UA	Chicago O'Hare	ORD		336	547	184	475	691	691	689	501	382	548	685	137	25.0%
United Express	UA	Cleveland	CLE													0	-
United Express	UA	New York Newark	EWR													0	-
United Express	UA	Washington Dulles	IAD		335	1,095	1,095	1,676	1,519	1,014	794	692	708	494	889	394	79.8%
US Airways Express	US	Baltimore	BWI	1,185												0	-
US Airways Express	US	Buffalo	BUF	1,032	986	909	865	889	839	830	812	94				0	-
US Airways Express	US	Charlotte	CLT					13	4	104	278	658	1,035	537	452	(86)	(15.9%)
US Airways Express	US	New York La Guardia	LGA											139	1,057	917	657.9%
US Airways Express	US	New York Newark	EWR		350											0	-
US Airways Express	US	Philadelphia	PHL		273	188	9	206	439	1,943	2,250	2,227	2,015	2,404	2,430	26	1.1%
US Airways Express	US	Pittsburgh	PIT					183	1,646	1,634	1,581	976	939	939	939	0	0.0%
US Airways Express	US	Rochester	ROC	937	1,225	641	552	575	574	569	613	530	574	478		(478)	(100.0%)
US Airways Express	US	Syracuse	SYR	732	878	481	574	584	478							0	-
US Airways Express	US	Washington National	DCA			236	313	392	551	899	863	683	904	1,334	1,411	77	5.8%
Subtotal				14,968	16,935	13,356	12,388	15,144	19,143	19,553	21,046	18,299	16,833	16,694	19,799	3,105	18.6%
Total				53,139	53,384	45,277	41,384	44,064	49,651	46,111	45,269	40,761	35,229	35,389	38,640	3,251	9.2%

Departing Seats

Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Regional/Commuter Carriers																	
Air Canada Express	AC	Montreal Dorval	YUL	19,392	25,894	25,474	27,025	21,557	19,475	19,402	19,814	19,453	19,157	19,399	18,739	(660)	(3.4%)
Air Canada Express	AC	Toronto	YYZ	61,991	58,254	53,518	46,094	35,666	38,242	42,200	41,623	40,366	38,410	36,960	38,342	1,381	3.7%
America West Express	HP	Columbus	CMH	22,493	55,179	67,786	24,993									0	-
American Connection	AA	St. Louis	STL				4,192	32,571	44,356	44,821	43,414	36,407	9,240			0	-
American Eagle	AA	Chicago O'Hare	ORD					416		34,094	80,300	57,606	50,374	79,594	95,985	16,391	20.6%
American Eagle	AA	New York J F Kennedy	JFK	48,166	39,105	33,165	8,880									0	-
American Eagle	AA	Raleigh/Durham	RDU		7,273	41,752	38,422	46,535	54,521	52,371	44,685	44,275	45,154	10,774		(10,774)	(100.0%)
American Eagle	AA	St. Louis	STL										4,600			0	-
Continental Connection	CO	Albany	ALB			2,815	11,889	16,337	961							0	-
Continental Connection	CO	Binghamton	BGM		2,964											0	-
Continental Connection	CO	Boston	BOS		8,238											0	-
Continental Connection	CO	Buffalo	BUF	1,683	11,050											0	-
Continental Connection	CO	Burlington	BTV	84	2,934											0	-
Continental Connection	CO	New York J F Kennedy	JFK		4,470											0	-
Continental Connection	CO	New York Newark	EWR									46,520	13,859	22,485	33,353	10,867	48.3%
Continental Connection	CO	Philadelphia	PHL		10,749											0	-
Continental Connection	CO	Rochester	ROC	1,767	10,806											0	-
Continental Connection	CO	Syracuse	SYR	1,851	8,447											0	-
Continental Express	CO	Cleveland	CLE	39,357	52,441	48,374	55,469	56,179	54,951	57,971	57,507	57,045	58,179	60,400	59,979	(421)	(0.7%)
Continental Express	CO	New York Newark	EWR	82,365	80,263	78,540	69,030	68,285	67,455	68,221	66,703	34,171	42,029	23,264	12,879	(10,386)	(44.6%)
Delta Connection	DL	Atlanta	ATL							5,820		310			3,396	3,396	-
Delta Connection	DL	Cincinnati	CVG							40,956	49,854	40,876	60,954	61,642	66,559	4,916	8.0%
Delta Connection	DL	Columbus	CMH					4,650	49,196	27,671	29,707	9,543				0	-
Delta Connection	DL	Detroit	DTW											54,265	82,915	28,649	52.8%
Delta Connection	DL	Fort Lauderdale/Hollywood	FLL									3,680				0	-
Delta Connection	DL	Fort Myers	RSW						42,840	25,100		290				0	-
Delta Connection	DL	Minneapolis	MSP											36,567	61,731	25,164	68.8%
Delta Connection	DL	Myrtle Beach	MYR	3,057												0	-
Delta Connection	DL	New York J F Kennedy	JFK							20,207	48,637	52,493	39,736	18,250	15,200	(3,050)	(16.7%)
Delta Connection	DL	Orlando	MCO							6,130						0	-
Delta Connection	DL	Raleigh/Durham	RDU											6,136	28,436	22,299	363.4%
Delta Connection	DL	Tampa	TPA									5,520				0	-
Delta Connection	DL	Washington National	DCA											11,324	51,524	40,200	355.0%
Delta Connection	DL	West Palm Beach	PBI									580				0	-
Frontier Express	F9	Milwaukee	MKE											6,313	18,746	12,433	196.9%
Independence Air	DH	Washington Dulles	IAD					57,714	98,307	4,650						0	-
Midway Airlines	JI	Raleigh/Durham	RDU	67,393	53,243											0	-
Midwest Connect	YX	Milwaukee	MKE	142	4,594	8,999	28,686	30,117	30,871	30,171	35,492	26,600				0	-
Northwest Airlink	NW	Detroit	DTW							4,771	16,493	30,948	53,556			0	-
Northwest Airlink	NW	Indianapolis	IND					5,664	31,907	31,257	30,400	30,500	3,857			0	-
Northwest Airlink	NW	Memphis	MEM									2,657				0	-
Northwest Airlink	NW	Minneapolis	MSP						1,550			4,299	34,895			0	-
Shuttle America	S5	Albany	ALB	3,286												0	-
Shuttle America	S5	Bedford	BED	11,671	1,714											0	-
Shuttle America	S5	Buffalo	BUF	16,857												0	-
Shuttle America	S5	Islip	ISP	1,329												0	-
Shuttle America	S5	Wilmington	ILG	7,936												0	-
Swissair	SR	New York J F Kennedy	JFK	1,023												0	-
Trans World Airlines	TW	New York J F Kennedy	JFK	31,842												0	-
United Express	UA	Chicago O'Hare	ORD		16,800	27,350	9,200	24,456	48,370	48,261	47,315	34,216	26,387	36,797	43,701	6,903	18.8%
United Express	UA	Cleveland	CLE													0	-
United Express	UA	New York Newark	EWR													0	-
United Express	UA	Washington Dulles	IAD		16,750	54,750	54,660	84,513	84,484	63,290	49,069	47,354	46,746	30,270	54,707	24,437	80.7%
US Airways Express	US	Baltimore	BWI	43,850												0	-
US Airways Express	US	Buffalo	BUF	38,200	36,493	33,638	32,000	32,121	28,607	28,215	27,623	3,206				0	-
US Airways Express	US	Charlotte	CLT					650	221	6,700	23,658	55,459	86,653	45,043	37,510	(7,533)	(16.7%)
US Airways Express	US	New York La Guardia	LGA											5,159	39,098	33,940	657.9%
US Airways Express	US	New York Newark	EWR		10,146											0	-
US Airways Express	US	Philadelphia	PHL		10,101	6,951	322	9,500	27,685	119,743	156,739	167,459	148,400	183,838	163,675	(20,163)	(11.0%)
US Airways Express	US	Pittsburgh	PIT					9,247	84,598	88,694	80,184	48,800	46,929	46,929	46,929	0	0.0%
US Airways Express	US	Rochester	ROC	34,658	45,325	23,733	20,429	21,280	19,555	19,351	20,832	18,005	19,501	16,242		(16,242)	(100.0%)
US Airways Express	US	Syracuse	SYR	27,084	32,470	14,421	10,898	11,093	9,077							0	-
US Airways Express	US	Washington National	DCA			7,071	13,054	19,813	34,454	59,076	51,252	42,356	60,107	89,629	89,940	311	0.3%
Subtotal				567,477	605,702	528,336	455,243	588,364	871,682	949,146	1,021,302	960,993	908,722	901,282	1,063,342	162,060	18.0%
Total				5,747,148	5,611,111	5,015,489	4,591,943	4,949,835	5,357,918	4,733,569	4,395,415	4,075,639	3,405,476	3,523,368	3,757,008	233,640	6.6%

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-4 Scheduled Passenger Operations by Market and Carrier for T.F. Green Airport

Departures

Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																	
American	AA	Chicago O'Hare	ORD	1,464	1,460	1,452	1,421	1,609	1,113	257						0	-
American	AA	Dallas/Fort Worth	DFW				61	366	365	90						0	-
Continental	CO	Cleveland	CLE	569	167	208	13	131	13	4						0	-
Continental	CO	Houston Intercontinental	IAH	366	243											0	-
Continental	CO	New York Newark	EWR	738	1,170	869	450	331	282	282	248	38				0	-
Delta	DL	Atlanta	ATL	1,464	1,460	1,678	1,825	1,830	1,976	827	256	25	43	510	1,043	533	104.4%
Delta	DL	Cincinnati	CVG	732	730	730	730	732	695	237						0	-
Delta	DL	Detroit	DTW											414	58	(356)	(86.1%)
Delta	DL	Fort Lauderdale/Hollywood	FLL		306											0	-
Delta	DL	Minneapolis	MSP											74		(74)	(100.0%)
Delta	DL	Orlando	MCO	732	730	730	424									0	-
Laker Airways (Bahamas)	7Z	Freeport	FPO					9								0	-
Northwest	NW	Detroit	DTW	1,682	1,631	1,534	1,513	1,512	1,550	1,395	1,278	1,120	1,006			0	-
Northwest	NW	Minneapolis	MSP			668	726	641	539	303	282					0	-
Sata Internacional	S4	Ponta Delgada	PDL					17		18	13	13				0	-
Southwest	WN	Baltimore	BWI	3,913	3,877	3,789	4,043	4,222	4,180	4,249	4,259	3,995	3,427	3,260	3,043	(217)	(6.7%)
Southwest	WN	Chicago Midway	MDW	1,072	1,022	1,013	1,056	1,089	1,349	1,373	1,400	1,390	1,231	1,135	1,095	(40)	(3.5%)
Southwest	WN	Fort Lauderdale/Hollywood	FLL	9	30			26			222	427	656	594	590	(4)	(0.7%)
Southwest	WN	Houston	HOU	152												0	-
Southwest	WN	Islip	ISP	608	1,369	1,351										0	-
Southwest	WN	Kansas City	MCI	366	365	361	365	366	365	31						0	-
Southwest	WN	Las Vegas	LAS					9	31	365	365	366	365	365	365	0	0.0%
Southwest	WN	Nashville	BNA	706	700	726	708	706	721	396	365	366	365	296	123	(173)	(58.4%)
Southwest	WN	Orlando	MCO	955	1,095	1,183	1,460	1,586	1,821	1,838	2,030	2,161	1,842	1,799	1,659	(139)	(7.8%)
Southwest	WN	Philadelphia	PHL					1,199	1,773	1,918	1,986	1,721	1,669	1,402	1,298	(104)	(7.4%)
Southwest	WN	Phoenix	PHX	366	703	730	730	732	726	730	638	366	365	361	365	4	1.2%
Southwest	WN	Tampa	TPA	745	730	818	1,095	1,085	1,086	1,091	1,095	993	826	813	808	(4)	(0.5%)
Spirit Airlines	NK	Detroit	DTW					61	120							0	-
Spirit Airlines	NK	Fort Lauderdale/Hollywood	FLL					131	568	400	151					0	-
Spirit Airlines	NK	Fort Myers	RSW					70	365	181	184					0	-
United	UA	Chicago O'Hare	ORD	1,477	1,491	1,670	1,666	1,555	1,460	1,491	1,491	1,003	730	644	626	(18)	(2.9%)
US Airways	US	Baltimore	BWI	2,462	2,101											0	-
US Airways	US	Charlotte	CLT	977	1,309	1,438	1,513	1,582	1,858	1,435	1,256	1,425	1,655	1,643	1,599	(44)	(2.7%)
US Airways	US	Fort Lauderdale/Hollywood	FLL					31	17							0	-
US Airways	US	Orlando	MCO	52	48			48	43	13	13	9				0	-
US Airways	US	Philadelphia	PHL	1,830	1,794	1,766	1,738	2,416	2,182	1,131	1,429	862	928	1,299	1,012	(287)	(22.1%)
US Airways	US	Pittsburgh	PIT	1,339	1,460	1,460	1,165	1,290	31							0	-
US Airways	US	Washington National	DCA	1,333	1,147	1,407	1,390	1,107	1,270	1,334	761	684	463	365	313	(52)	(14.3%)
Subtotal				26,108	27,136	25,580	24,093	26,488	26,499	21,387	19,720	16,965	15,571	14,974	13,998	(976)	(6.5%)
Regional/Commuter Carriers																	
Air Canada Express	AC	Toronto	YYZ	989	991	835	906	798	734	699	700	658	639	625	591	(34)	(5.5%)
American Eagle	AA2	Chicago O'Hare	ORD							842	1,095	784				0	-
American Eagle	AA2	New York J F Kennedy	JFK	1,291	1,404	731	330									0	-
American Eagle	AA2	New York La Guardia	LGA	2,756	1,788	961										0	-
American Eagle	AA2	Raleigh/Durham	RDU					643	343							0	-
Cape Air	9K	Hyannis	HYA							26						0	-
Cape Air	9K	Martha's Vineyard	MVY	1,762	1,871	1,948	1,502	1,960	1,015	1,045	1,014	967	795	747	672	(75)	(10.0%)
Cape Air	9K	Nantucket	ACK	2,453	2,653	2,592	1,975	2,765	1,199	1,285	1,183	879	733	681	668	(13)	(1.9%)
Continental Connection	CO	Albany	ALB		944	1,116	863	702	51							0	-
Continental Connection	CO	Boston	BOS		51											0	-
Continental Connection	CO	New York Newark	EWR									625	1,043	427	171	(257)	(60.1%)
Continental Connection	CO	Plattsburgh	PLB		22											0	-
Continental Express	CO	Cleveland	CLE	699	1,190	1,186	1,200	1,119	1,238	1,286	1,326	1,290	1,264	1,217	1,079	(138)	(11.3%)
Continental Express	CO	New York Newark	EWR	1,482	465	650	1,019	1,395	1,455	1,438	1,481	1,080	417	1,028	1,268	240	23.3%
Delta Connection	DL	Atlanta	ATL						31	705	1,291	1,373	1,136	724	9	(715)	(98.8%)
Delta Connection	DL	Cincinnati	CVG		275	365	334	335	373	749	978	993	816	43		(43)	(100.0%)
Delta Connection	DL	Detroit	DTW											1,324	1,995	671	50.6%
Delta Connection	DL	Minneapolis	MSP											347	392	44	12.7%
Delta Connection	DL	New York J F Kennedy	JFK							542	1,238	671	90			0	-
Delta Connection	DL	New York La Guardia	LGA	610	155											0	-
Delta Connection	DL	Raleigh/Durham	RDU												131	131	-
Delta Connection	DL	Washington National	DCA												685	685	-
Independence Air	DH	Washington Dulles	IAD					875	1,509	93						0	-
Midway Airlines	JI	Raleigh/Durham	RDU		510											0	-
Northwest Airlink	NW	Detroit	DTW									113	373			0	-
Northwest Airlink	NW	Minneapolis	MSP		302	93	40	79	31			271	262			0	-
Swissair	SR	New York J F Kennedy	JFK	31												0	-
United Express	UA	Chicago O'Hare	ORD					214	262	334	217	213	370	455	375	(80)	(17.5%)
United Express	UA	Washington Dulles	IAD	1,468	1,507	1,460	1,460	1,876	1,716	1,656	1,589	1,464	1,460	1,569	1,421	(148)	(9.4%)
US Airways Express	US	Albany	ALB	679												0	-
US Airways Express	US	Boston	BOS	48												0	-
US Airways Express	US	Charlotte	CLT					13	18	338	491	348	92	126	147	22	17.1%
US Airways Express	US	Hyannis	HYA			183	17									0	-
US Airways Express	US	Nantucket	ACK				9									0	-
US Airways Express	US	New York La Guardia	LGA	2,298	2,233	1,930	1,876	1,808	1,669	1,816	1,855	1,589	1,705	1,222	957	(266)	(21.7%)
US Airways Express	US	New York Newark	EWR	1,569	1,507	80										0	-
US Airways Express	US	Philadelphia	PHL	366	365	365	9	22	716	1,685	1,356	1,800	1,788	1,526	1,713	187	12.3%
US Airways Express	US	Pittsburgh	PIT					183	1,360	1,395	978	303				0	-
US Airways Express	US	Plattsburgh	PLB	26												0	-
US Airways Express	US	Washington National	DCA					143	482	625	1,254	1,373	1,256	1,373	1,304	(70)	(5.1%)
Subtotal				18,527	18,233	14,496	11,538	14,930	14,200	16,560	18,046	16,795	14,239	13,436	13,577	142	1.1%
Total				44,635	45,369	40,076	35,631	41,419	40,699	37,946	37,766	33,760	29,809	28,409	27,575	(834)	(2.9%)

Departing Seats

Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																	
American	AA	Chicago O'Hare	ORD	203,104	188,340	187,253	183,309	207,543	143,522	33,171						0	-
American	AA	Dallas/Fort Worth	DFW				7,869	47,214	47,085	11,610						0	-
Continental	CO	Cleveland	CLE	69,771	20,446	24,382	1,629	15,622	1,630	446						0	-
Continental	CO	Houston Intercontinental	IAH	45,946	28,062											0	-
Continental	CO	New York Newark	EWR	96,448	148,092	105,448	53,213	38,535	34,808	29,298	27,309	4,348				0	-
Delta	DL	Atlanta	ATL	207,888	232,070	283,761	294,173	289,611	290,915	108,427	36,556	3,570	6,147	72,461	150,526	78,065	107.7%
Delta	DL	Cincinnati	CVG	103,944	105,055	129,715	129,625	103,944	89,235	23,714						0	-
Delta	DL	Detroit	DTW											50,065	7,139	(42,927)	(85.7%)
Delta	DL	Fort Lauderdale/Hollywood	FLL		36,414											0	-
Delta	DL	Minneapolis	MSP											9,211		(9,211)	(100.0%)
Delta	DL	Orlando	MCO	87,108	86,870	86,870	50,456									0	-
Laker Airways (Bahamas)	7Z	Freeport	FPO					1,329								0	-
Northwest	NW	Detroit	DTW	200,509	201,221	185,628	187,255	203,837	202,255	191,678	163,119	144,120	104,662			0	-
Northwest	NW	Minneapolis	MSP			82,832	95,305	85,995	68,977	41,988	34,986					0	-
Sata Internacional	S4	Ponta Delgada	PDL					3,486		3,514	2,629	2,629				0	-
Southwest	WN	Baltimore	BWI	535,911	531,110	519,132	553,911	578,063	572,699	582,133	581,240	547,223	468,695	442,637	415,554	(27,083)	(6.1%)
Southwest	WN	Chicago Midway	MDW	146,844	139,975	138,399	144,672	149,232	184,813	188,160	191,469	190,410	167,712	153,121	149,877	(3,244)	(2.1%)
Southwest	WN	Fort Lauderdale/Hollywood	FLL	1,194	4,149			3,562			30,473	58,499	89,852	81,378	80,791	(587)	(0.7%)
Southwest	WN	Houston	HOU	20,824												0	-
Southwest	WN	Islip	ISP	83,237	187,494	185,126										0	-
Southwest	WN	Kansas City	MCI	50,142	50,005	49,398	50,005	50,142	50,005	4,247						0	-
Southwest	WN	Las Vegas	LAS					1,194	4,247	50,005	50,005	50,142	50,005	50,005	50,005	0	0.0%
Southwest	WN	Nashville	BNA	96,702	95,861	99,403	97,055	96,722	98,816	54,252	50,005	50,142	49,154	39,578	16,067	(23,512)	(59.4%)
Southwest	WN	Orlando	MCO	130,855	150,015	162,012	200,020	217,302	249,418	251,806	278,130	296,077	252,021	245,156	225,244	(19,912)	(8.1%)
Southwest	WN	Philadelphia	PHL					164,224	238,366	262,328	272,023	230,076	228,594	192,054	177,001	(15,053)	(7.8%)
Southwest	WN	Phoenix	PHX	50,142	96,370	100,010	100,010	100,284	99,403	100,010	87,406	50,142	50,005	49,398	50,005	607	1.2%
Southwest	WN	Tampa	TPA	102,065	100,010	112,007	150,015	148,625	148,821	149,408	150,015	136,100	112,247	111,231	109,572	(1,659)	(1.5%)
Spirit Airlines	NK	Detroit	DTW					9,150	18,000							0	-
Spirit Airlines	NK	Fort Lauderdale/Hollywood	FLL					19,586	84,117	57,411	21,095					0	-
Spirit Airlines	NK	Fort Myers	RSW					10,436	54,750	29,706	32,533					0	-
United	UA	Chicago O'Hare	ORD	239,076	239,727	245,812	242,105	234,843	200,677	189,260	179,413	124,349	98,155	82,802	78,487	(4,315)	(5.2%)
US Airways	US	Baltimore	BWI	263,921	239,659											0	-
US Airways	US	Charlotte	CLT	128,984	181,656	216,134	218,364	223,314	274,039	224,384	181,130	187,163	208,090	233,886	226,854	(7,032)	(3.0%)
US Airways	US	Fort Lauderdale/Hollywood	FLL					3,941	2,186							0	-
US Airways	US	Orlando	MCO	5,605	5,440			6,126	5,831	1,831	1,831	1,080				0	-
US Airways	US	Philadelphia	PHL	253,015	257,340	265,192	254,348	345,461	312,890	149,514	170,237	90,225	97,365	130,008	101,987	(28,021)	(21.6%)
US Airways	US	Pittsburgh	PIT	185,109	184,748	219,611	161,979	174,598	4,446							0	-
US Airways	US	Washington National	DCA	167,278	145,960	175,855	178,061	149,503	170,009	176,649	96,999	81,540	58,046	49,501	44,006	(5,495)	(11.1%)
Subtotal				3,475,622	3,656,088	3,573,982	3,353,377	3,683,422	3,651,961	2,914,952	2,638,603	2,247,835	2,040,751	1,992,492	1,883,114	(109,378)	(5.5%)
Regional/Commuter Carriers																	
Air Canada Express	AC	Toronto	YYZ	37,482	36,656	29,701	17,478	14,364	13,783	13,286	13,292	12,494	12,136	11,880	11,232	(649)	(5.5%)
American Eagle	AA2	Chicago O'Hare	ORD							37,107	48,386	34,490				0	-
American Eagle	AA2	New York J F Kennedy	JFK	42,589	46,341	24,979	12,210									0	-
American Eagle	AA2	New York La Guardia	LGA	90,957	63,908	35,568										0	-
American Eagle	AA2	Raleigh/Durham	RDU					25,643	13,081							0	-
Cape Air	9K	Hyannis	HYA							231						0	-
Cape Air	9K	Martha's Vineyard	MVY	15,861	16,839	17,535	13,515	17,640	9,132	9,408	9,129	8,707	7,154	6,722	6,048	(674)	(10.0%)
Cape Air	9K	Nantucket	ACK	22,073	23,874	23,332	17,775	24,885	10,787	11,569	10,650	7,912	6,593	6,128	6,012	(116)	(1.9%)
Continental Connection	CO	Albany	ALB		17,941	21,212	16,397	13,335	961							0	-
Continental Connection	CO	Boston	BOS		961											0	-
Continental Connection	CO	New York Newark	EWR									46,261	77,150	31,630	6,316	(25,313)	(80.0%)
Continental Connection	CO	Plattsburgh	PLB		415											0	-
Continental Express	CO	Cleveland	CLE	34,936	59,234	59,266	59,930	55,900	61,900	64,307	66,250	64,500	63,214	60,836	53,943	(6,893)	(11.3%)
Continental Express	CO	New York Newark	EWR	86,552	23,216	32,493	50,770	67,702	71,185	70,697	72,165	53,297	20,871	51,407	63,407	12,000	23.3%
Delta Connection	DL	Atlanta	ATL						1,550	37,276	70,664	84,816	78,920	52,959	662	(52,297)	(98.7%)
Delta Connection	DL	Cincinnati	CVG		13,750	18,250	16,700	16,750	19,109	43,523	53,217	51,691	41,597	2,150		(2,150)	(100.0%)
Delta Connection	DL	Detroit	DTW											78,701	111,901	33,199	42.2%
Delta Connection	DL	Minneapolis	MSP											26,192	29,553	3,361	12.8%
Delta Connection	DL	New York J F Kennedy	JFK							20,043	50,095	33,550	4,500			0	-
Delta Connection	DL	New York La Guardia	LGA	19,520	4,960											0	-
Delta Connection	DL	Raleigh/Durham	RDU												6,557	6,557	-
Delta Connection	DL	Washington National	DCA												34,243	34,243	-
Independence Air	DH	Washington Dulles	IAD					43,764	75,429	4,650						0	-
Midway Airlines	JI	Raleigh/Durham	RDU		25,507											0	-
Northwest Airlink	NW	Detroit	DTW									8,610	25,817			0	-
Northwest Airlink	NW	Minneapolis	MSP		15,079	4,650	1,986	3,943	1,550			20,563	19,912			0	-
Swissair	SR	New York J F Kennedy	JFK	1,023												0	-
United Express	UA	Chicago O'Hare	ORD					10,700	18,330	23,380	14,847	14,077	24,401	29,820	24,079	(5,741)	(19.3%)
United Express	UA	Washington Dulles	IAD	52,832	74,367	73,000	73,000	93,779	85,821	85,133	90,282	88,930	90,648	99,719	89,593	(10,126)	(10.2%)
US Airways Express	US	Albany	ALB	12,898												0	-
US Airways Express	US	Boston	BOS	909												0	-
US Airways Express	US	Charlotte	CLT					657	879	26,581	38,945	28,677	5,998	10,047	12,035	1,988	19.8%
US Airways Express	US	Hyannis	HYA			3,480	326									0	-
US Airways Express	US	Nantucket	ACK				292									0	-
US Airways Express	US	New York La Guardia	LGA	84,116	81,795	57,349	48,101	50,163	55,077	59,675	57,420	53,702	63,090	45,225	33,141	(12,084)	(26.7%)
US Airways Express	US	New York Newark	EWR	31,176	43,707	2,312										0	-
US Airways Express	US	Philadelphia	PHL	13,542	13,505	13,505	322	1,324	45,199	105,463	88,590	135,360	123,761	107,790	122,386	14,596	13.5%
US Airways Express	US	Pittsburgh	PIT					9,157	72,808	76,891	51,251	15,136				0	-
US Airways Express	US	Plattsburgh	PLB	497												0	-
US Airways Express	US	Washington National	DCA					7,171	30,996	31,326	78,780	84,215	79,539	92,151	95,527	3,376	3.7%
Subtotal				546,963	562,057	416,630	328,803	456,879	587,576	720,547	813,962	846,987	745,302	713,356	706,634	(6,721)	(0.9%)
Total				4,022,585	4,218,145	3,990,612	3,682,181	4,140,301	4,239,537	3,635,498	3,452,565	3,094,822	2,786,053	2,705,848	2,589,748	(116,100)	(4.3%)

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-5 Scheduled Passenger Operations by Market and Carrier for Manchester-Boston Regional Airport

Departures

Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																	
Boston-Maine Airways	PN	Myrtle Beach	MYR				26	83								0	-
Boston-Maine Airways	PN	Portsmouth	PSM				26	183								0	-
Boston-Maine Airways	PN	Sanford	SFB				13	87								0	-
Continental	CO	Cleveland	CLE	130	91								9			0	-
Continental	CO	New York Newark	EWR	462	874	694	326	314	286	260	4					0	-
Delta	DL	Atlanta	ATL	244	730	944	881	732	668			13		275	565	290	105.6%
Delta	DL	Cincinnati	CVG		214	579	730	710	664							0	-
Delta	DL	Detroit	DTW											796		(796)	(100.0%)
Northwest	NW	Detroit	DTW	1,609	1,613	1,534	1,429	1,460	1,399	1,301	1,199	832	778			0	-
Northwest	NW	Minneapolis	MSP				214	362	365	241	153					0	-
Southwest	WN	Baltimore	BWI	2,828	2,812	3,128	3,625	3,874	3,850	3,859	3,898	3,638	3,312	2,891	2,761	(130)	(4.5%)
Southwest	WN	Chicago Midway	MDW	706	708	704	669	693	1,355	1,399	1,631	1,651	1,253	1,144	1,244	100	8.8%
Southwest	WN	Denver	DEN												92	92	-
Southwest	WN	Fort Lauderdale/Hollywood	FLL		9		22	9				254	120	9	9	0	0.0%
Southwest	WN	Kansas City	MCI	366	365	365	365	305								0	-
Southwest	WN	Las Vegas	LAS				122	375	365	365	365	366	365	365	365	0	0.0%
Southwest	WN	Nashville	BNA	397	721	730	730	715	730	62						0	-
Southwest	WN	Orlando	MCO	410	697	818	1,095	1,129	1,468	1,456	1,774	1,602	1,201	1,125	977	(148)	(13.2%)
Southwest	WN	Philadelphia	PHL					788	1,786	1,756	2,005	2,026	1,894	1,411	1,325	(86)	(6.1%)
Southwest	WN	Phoenix	PHX								122	366	365	322	273	(49)	(15.2%)
Southwest	WN	Tampa	TPA		306	453	730	845	1,099	1,095	1,030	741	673	782	629	(153)	(19.6%)
United	UA	Chicago O'Hare	ORD	1,403	1,431	1,694	1,460	1,464	1,339	1,096	1,067	824	608			0	-
United	UA	Portland (ME)	PWM	57	90											0	-
US Airways	US	Baltimore	BWI	1,782	1,444											0	-
US Airways	US	Charlotte	CLT		62	730	901	1,276	1,308	660	623	689	378	365	51	(314)	(85.9%)
US Airways	US	Orlando	MCO	52	48											0	-
US Airways	US	Philadelphia	PHL	1,821	1,821	1,812	1,602	1,806	2,021	683	634	366	395	365	313	(52)	(14.3%)
US Airways	US	Pittsburgh	PIT	1,085	1,095	1,086	820	553								0	-
US Airways	US	Washington National	DCA	675	599			113	575	539	304	296				0	-
Subtotal				14,026	15,731	15,270	15,787	17,876	19,279	14,771	14,810	13,664	11,352	9,850	8,604	(1,246)	(12.6%)
Regional/Commuter Carriers																	
Air Canada Express	AC	Montreal Dorval	YUL		423											0	-
Air Canada Express	AC	Toronto	YYZ	339	1,299	1,295	1,391	1,024	930	908	917	910	908	707	403	(305)	(43.1%)
American Eagle	AA	New York La Guardia	LGA	1,833	810											0	-
Boston-Maine Airways	E9	Bangor	BGR				192	4								0	-
Boston-Maine Airways	E9	Martha's Vineyard	MVY				105									0	-
Boston-Maine Airways	E9	Nantucket	ACK				214									0	-
Boston-Maine Airways	E9	New London/Groton	GON				118	22								0	-
Boston-Maine Airways	E9	Portsmouth	PSM				148	4								0	-
Boston-Maine Airways	E9	Saint John	YSJ				139									0	-
Continental Connection	CO	Albany	ALB	80	1,131	1,116	1,130	1,007	313							0	-
Continental Connection	CO	New York J F Kennedy	JFK		349											0	-
Continental Connection	CO	New York Newark	EWR									62	337	141	175	34	23.9%
Continental Connection	CO	Plattsburgh	PLB		39											0	-
Continental Connection	CO	Rochester	ROC	44	129											0	-
Continental Connection	CO	Syracuse	SYR	22	64											0	-
Continental Connection	CO	Westchester County	HPN		328											0	-
Continental Express	CO	Cleveland	CLE	593	914	1,343	1,173	1,198	1,186	1,213	1,236	1,212	1,178	1,178	935	(244)	(20.7%)
Continental Express	CO	New York Newark	EWR	1,028	603	762	1,125	1,150	1,165	1,196	1,451	1,380	1,072	1,267	1,215	(51)	(4.1%)
Delta Connection	DL	Atlanta	ATL	488			214	366	485	1,621	1,176	692	365	90		(90)	(100.0%)
Delta Connection	DL	Bangor	BGR	244												0	-
Delta Connection	DL	Cincinnati	CVG	1,673	1,246	881	726	750	735	986	982	775				0	-
Delta Connection	DL	Detroit	DTW											499	1,858	1,359	272.2%
Delta Connection	DL	New York J F Kennedy	JFK							453	1,059					0	-
Delta Connection	DL	New York La Guardia	LGA	727	124		825	1,067	486							0	-
Independence Air	DH	Washington Dulles	IAD					1,439	1,568	93						0	-
Northwest Airlink	NW	Detroit	DTW					13		89	49	397	359			0	-
Northwest Airlink	NW	Minneapolis	MSP				214	324	233	89	153	271	92			0	-
United Express	UA	Chicago O'Hare	ORD				83	213	31	333	363	322	388	1,040	983	(57)	(5.5%)
United Express	UA	Washington Dulles	IAD		124	1,460	1,460	1,678	1,760	1,316	1,429	1,098	1,161	1,104	658	(446)	(40.4%)
US Airways Express	US	Boston	BOS									73				0	-
US Airways Express	US	Charlotte	CLT						307	396	416	196	227	153	318	165	107.9%
US Airways Express	US	New York La Guardia	LGA	2,583	2,095	2,109	2,335	2,632	2,499	2,454	2,454	2,157	1,464	1,381	1,269	(112)	(8.1%)
US Airways Express	US	Philadelphia	PHL				275	370	562	2,120	1,720	1,878	1,929	2,116	2,068	(48)	(2.3%)
US Airways Express	US	Pittsburgh	PIT				214	567	1,022							0	-
US Airways Express	US	Washington National	DCA			844	1,017	976	508	547	782	845	1,008	1,039	1,043	4	0.4%
Subtotal				9,655	9,677	9,809	13,098	14,804	13,788	13,815	14,186	12,269	10,486	10,716	10,925	209	1.9%
Total				23,681	25,408	25,079	28,885	32,680	33,067	28,586	28,996	25,933	21,839	20,566	19,529	(1,037)	(5.0%)

Departing Seats

Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																	
Boston-Maine Airways	PN	Myrtle Beach	MYR				3,943	12,429								0	-
Boston-Maine Airways	PN	Portsmouth	PSM				3,921	27,471								0	-
Boston-Maine Airways	PN	Sanford	SFB				1,971	13,114								0	-
Continental	CO	Cleveland	CLE	16,151	10,857								1,038			0	-
Continental	CO	New York Newark	EWR	62,358	105,765	80,049	37,310	36,123	30,953	27,025	446					0	-
Delta	DL	Atlanta	ATL	34,648	103,660	134,048	125,102	103,944	94,856			1,826		39,050	81,600	42,550	109.0%
Delta	DL	Cincinnati	CVG		30,388	82,218	103,660	100,840	86,583							0	-
Delta	DL	Detroit	DTW											89,289		(89,289)	(100.0%)
Northwest	NW	Detroit	DTW	194,058	214,073	205,234	193,043	202,623	180,879	181,073	149,221	101,760	93,450			0	-
Northwest	NW	Minneapolis	MSP				26,536	44,835	46,933	30,575	18,972					0	-
Southwest	WN	Baltimore	BWI	387,397	385,205	428,516	496,645	530,588	527,405	525,342	530,545	496,372	450,616	393,093	376,945	(16,148)	(4.1%)
Southwest	WN	Chicago Midway	MDW	96,702	97,055	96,448	91,712	94,744	185,481	191,722	222,957	226,101	169,754	155,466	169,440	13,975	9.0%
Southwest	WN	Denver	DEN												12,604	12,604	-
Southwest	WN	Fort Lauderdale/Hollywood	FLL		1,194		2,955	1,194				34,692	16,440	1,194	1,194	0	0.0%
Southwest	WN	Kansas City	MCI	50,142	50,005	50,005	50,005	41,785								0	-
Southwest	WN	Las Vegas	LAS				16,714	51,336	50,005	50,005	50,005	50,142	50,005	50,005	50,005	0	0.0%
Southwest	WN	Nashville	BNA	54,389	98,816	99,682	99,686	97,896	99,879	8,494						0	-
Southwest	WN	Orlando	MCO	56,111	95,469	112,007	150,015	154,673	201,175	199,413	243,032	219,402	164,332	154,145	133,829	(20,315)	(13.2%)
Southwest	WN	Philadelphia	PHL					107,995	244,356	240,533	274,328	269,953	259,275	192,456	180,871	(11,585)	(6.0%)
Southwest	WN	Phoenix	PHX								16,714	50,142	50,005	44,114	37,401	(6,713)	(15.2%)
Southwest	WN	Tampa	TPA		41,922	62,002	100,010	115,693	150,165	150,015	141,071	101,283	92,240	107,173	86,212	(20,961)	(19.6%)
United	UA	Chicago O'Hare	ORD	221,523	231,477	248,062	219,888	209,179	179,151	138,080	129,086	106,943	85,929			0	-
United	UA	Portland (ME)	PWM	7,241	13,230											0	-
US Airways	US	Baltimore	BWI	191,078	163,901											0	-
US Airways	US	Charlotte	CLT		8,122	98,076	118,445	167,699	178,836	91,141	85,232	86,775	53,676	52,560	7,406	(45,154)	(85.9%)
US Airways	US	Orlando	MCO	5,605	5,440											0	-
US Airways	US	Philadelphia	PHL	222,331	226,973	245,108	212,916	244,129	274,215	95,260	73,396	48,403	56,219	33,132	30,973	(2,159)	(6.5%)
US Airways	US	Pittsburgh	PIT	139,837	142,409	150,124	103,168	77,259								0	-
US Airways	US	Washington National	DCA	82,085	77,187			14,323	77,461	77,575	43,717	40,724				0	-
Subtotal				1,821,657	2,103,146	2,091,581	2,157,645	2,449,873	2,608,335	2,006,253	1,978,722	1,834,518	1,542,979	1,311,677	1,168,481	(143,196)	(10.9%)
Regional/Commuter Carriers																	
Air Canada Express	AC	Montreal Dorval	YUL		7,606											0	-
Air Canada Express	AC	Toronto	YYZ	5,616	23,385	23,305	25,863	18,758	17,439	17,260	17,415	17,295	17,252	13,441	7,652	(5,790)	(43.1%)
American Eagle	AA	New York La Guardia	LGA	60,480	26,735											0	-
Boston-Maine Airways	E9	Bangor	BGR				3,453	80								0	-
Boston-Maine Airways	E9	Martha's Vineyard	MVY				1,885									0	-
Boston-Maine Airways	E9	Nantucket	ACK				3,844									0	-
Boston-Maine Airways	E9	New London/Groton	GON				2,124	399								0	-
Boston-Maine Airways	E9	Portsmouth	PSM				2,667	80								0	-
Boston-Maine Airways	E9	Saint John	YSJ				2,510									0	-
Continental Connection	CO	Albany	ALB	1,515	21,486	21,212	21,470	19,130	5,944							0	-
Continental Connection	CO	New York J F Kennedy	JFK		6,623											0	-
Continental Connection	CO	New York Newark	EWR									4,588	24,906	9,483	6,486	(2,997)	(31.6%)
Continental Connection	CO	Plattsburgh	PLB		746											0	-
Continental Connection	CO	Rochester	ROC	841	2,443											0	-
Continental Connection	CO	Syracuse	SYR	421	1,221											0	-
Continental Connection	CO	Westchester County	HPN		6,224											0	-
Continental Express	CO	Cleveland	CLE	29,614	45,371	66,906	58,053	59,729	58,991	60,240	60,374	60,487	58,893	58,921	46,736	(12,186)	(20.7%)
Continental Express	CO	New York Newark	EWR	64,944	29,821	38,107	55,935	57,169	58,140	59,779	72,054	68,613	53,579	63,336	60,764	(2,571)	(4.1%)
Delta Connection	DL	Atlanta	ATL	24,400			10,700	18,300	26,620	107,251	82,310	48,440	25,550	6,300		(6,300)	(100.0%)
Delta Connection	DL	Bangor	BGR	12,200												0	-
Delta Connection	DL	Cincinnati	CVG	83,657	62,300	44,050	40,657	39,299	38,426	54,667	55,601	39,633				0	-
Delta Connection	DL	Detroit	DTW											32,795	95,802	63,007	192.1%
Delta Connection	DL	New York J F Kennedy	JFK							16,766	41,783					0	-
Delta Connection	DL	New York La Guardia	LGA	36,357	6,200		41,250	53,350	24,300							0	-
Independence Air	DH	Washington Dulles	IAD					71,971	78,379	4,650						0	-
Northwest Airlink	NW	Detroit	DTW					664		4,450	3,011	30,242	25,524			0	-
Northwest Airlink	NW	Minneapolis	MSP				10,700	16,179	11,664	4,450	9,358	20,563	6,992			0	-
United Express	UA	Chicago O'Hare	ORD				4,157	10,650	2,170	23,310	24,922	21,200	25,402	67,675	62,096	(5,579)	(8.2%)
United Express	UA	Washington Dulles	IAD		6,200	73,000	73,000	83,900	90,419	65,881	75,866	61,533	62,534	55,951	33,514	(22,437)	(40.1%)
US Airways Express	US	Boston	BOS									1,384				0	-
US Airways Express	US	Charlotte	CLT						21,863	29,701	33,671	16,039	19,547	13,146	27,181	14,036	106.8%
US Airways Express	US	New York La Guardia	LGA	96,936	77,531	77,425	81,678	90,511	86,492	84,057	83,265	73,334	49,761	49,420	43,737	(5,683)	(11.5%)
US Airways Express	US	Philadelphia	PHL				12,957	19,654	30,239	115,950	107,421	127,396	118,750	140,277	135,156	(5,120)	(3.7%)
US Airways Express	US	Pittsburgh	PIT				10,700	28,935	51,107							0	-
US Airways Express	US	Washington National	DCA			29,377	38,697	48,684	25,379	35,327	55,456	58,271	76,259	81,095	81,683	588	0.7%
Subtotal				416,980	323,892	373,382	502,301	637,439	627,572	683,739	722,508	649,020	564,949	591,840	600,808	8,967	1.5%
Total				2,238,636	2,427,038	2,464,963	2,659,946	3,087,313	3,235,907	2,689,992	2,701,229	2,483,538	2,107,928	1,903,517	1,769,288	(134,229)	(7.1%)

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-6 Scheduled Passenger Operations by Market and Carrier for Portland International Jetport

Departures

Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																	
AirTran	FL	Atlanta	ATL										153	92	167	75	81.4%
AirTran	FL	Baltimore	BWI								589.714	1,012	948	944	927	(17)	(1.8%)
AirTran	FL	Orlando	MCO								91.5714	156	91	52	52	0	0.8%
Continental	CO	Cleveland	CLE										9			0	-
Continental	CO	New York Newark	EWR		62		66									0	-
Delta	DL	Atlanta	ATL	732	730	730	730	732	486			118	114	424	793	370	87.2%
Delta	DL	Cincinnati	CVG	1,089	853	730	730	732	486	92						0	-
Independence Air	DH	Washington Dulles	IAD						307							0	-
jetBlue	B6	New York J F Kennedy	JFK							856	1504.29	1,571	1,527	1,201	1,323	122	10.1%
jetBlue	B6	Orlando	MCO									296	286	212	181	(31)	(14.6%)
Northwest	NW	Detroit	DTW	523	744	458	368	368	427	612	307					0	-
Trans World Airlines	TW	Hartford	BDL	305												0	-
United	UA	Chicago O'Hare	ORD	728	608											0	-
United	UA	Manchester	MHT	366	243											0	-
US Airways	US	Charlotte	CLT										122	395	352	(43)	(11.0%)
US Airways	US	Philadelphia	PHL	1,312	1,460	1,124	1,399	294	154						217	217	-
US Airways	US	Pittsburgh	PIT	1,081	1,095	1,031	184									0	-
US Airways	US	Washington National	DCA					62	52							0	-
Subtotal				6,135	5,795	4,073	3,477	2,188	1,912	1,560	2,493	3,153	3,251	3,320	4,013	693	20.9%
Regional/Commuter Carriers																	
Air Canada Express	AC	Montreal Dorval	YUL	344	348											0	-
Air Canada Express	AC	Toronto	YYZ											481	783	302	62.7%
America West	HP	New York Newark	EWR	52												0	-
American Eagle	AA	Boston	BOS	3,804	2,273	1,570	334	105								0	-
American Eagle	AA	Chicago O'Hare	ORD		381	726	761	702								0	-
American Eagle	AA	New York La Guardia	LGA	2,033	1,617	960	819	690								0	-
Continental Connection	CO	Albany	ALB		507	1,116	1,199	1,268	291							0	-
Continental Connection	CO	Boston	BOS	204	1,493				241							0	-
Continental Connection	CO	New York Newark	EWR									718	1,412	1,426	1,343	(83)	(5.8%)
Continental Connection	CO	Presque Isle	PQI		30											0	-
Continental Express	CO	Cleveland	CLE	425	569	197	135	135	223	210	236	324	276	188	188	0	0.0%
Continental Express	CO	New York Newark	EWR	1,429	1,355	1,443	1,355	1,425	1,394	1,420	1,438	746	13	4	83	79	1975.0%
Delta Connection	DL	Atlanta	ATL						700	1,369	1,055	784	742	350		(350)	(100.0%)
Delta Connection	DL	Boston	BOS		642	1,672	1,582	1,464	1,153							0	-
Delta Connection	DL	Cincinnati	CVG		61	120		184	600	942	1,013	706				0	-
Delta Connection	DL	Detroit	DTW											1,217	1,314	96	7.9%
Delta Connection	DL	New York J F Kennedy	JFK							436	1,391	1,273	1,286	270		(270)	(100.0%)
Delta Connection	DL	New York La Guardia	LGA	475	766	1,095	1,095	1,098	1,095	1,000	585			786	1,034	249	31.6%
Independence Air	DH	Washington Dulles	IAD					1,197	1,384	93						0	-
Lufthansa German Airlines	LH	Washington Dulles	IAD	31												0	-
Northwest Airlink	NW	Detroit	DTW	484	78	334	772	1,027	915	329	585	845	997			0	-
Northwest Airlink	NW	Minneapolis	MSP			22	141	441	404	91	122	122	30			0	-
Starlink Aviation	Q4	Yarmouth	YQI										393	521	521	0	0.0%
Swissair	SR	Boston	BOS	31												0	-
United Express	UA	Chicago O'Hare	ORD		244	1,095	1,340	1,464	1,095	1,252	1,265	1,255	1,257	1,249	1,176	(72)	(5.8%)
United Express	UA	Washington Dulles	IAD	996	975	1,309	1,117	1,342	1,456	1,408	1,112	1,072	1,099	1,078	1,066	(13)	(1.2%)
US Airways Express	US	Bangor	BGR	231	252	13										0	-
US Airways Express	US	Boston	BOS	2,229	1,748	698	204									0	-
US Airways Express	US	Charlotte	CLT					193	365	431	365	541	384	88	18	(70)	(79.8%)
US Airways Express	US	New York La Guardia	LGA	1,218	1,231	1,404	1,356	1,364	1,665	1,843	1,767	1,940	1,874	1,647	1,526	(121)	(7.3%)
US Airways Express	US	Philadelphia	PHL				61	1,222	1,913	2,148	2,042	2,000	1,891	1,947	1,987	39	2.0%
US Airways Express	US	Pittsburgh	PIT				484	799	219							0	-
US Airways Express	US	Plattsburgh	PLB	48												0	-
US Airways Express	US	Presque Isle	PQI				131	130								0	-
US Airways Express	US	Washington National	DCA	1,089	890	865	1,022	984	1,149	1,173	1,377	1,574	1,113	1,043	1,043	0	0.0%
US Airways Express	US	Westchester County	HPN	65												0	-
Subtotal				15,187	15,460	14,639	13,909	17,235	16,261	14,145	14,355	13,898	12,766	12,296	12,081	(215)	(1.7%)
Total				21,322	21,255	18,712	17,386	19,423	18,174	15,705	16,848	17,051	16,017	15,615	16,094	478	3.1%

Departing Seats

Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																	
AirTran	FL	Atlanta	ATL										18,189	10,764	19,522	8,758	81.4%
AirTran	FL	Baltimore	BWI								68,997	118,437	111,024	112,951	109,024	(3,928)	(3.5%)
AirTran	FL	Orlando	MCO								10,714	18,367	11,117	6,503	6,355	(148)	(2.3%)
Continental	CO	Cleveland	CLE										1,373			0	-
Continental	CO	New York Newark	EWR		7,068		7,675									0	-
Delta	DL	Atlanta	ATL	103,944	103,660	103,660	103,660	103,944	61,229			16,715	16,208	60,167	114,597	54,429	90.5%
Delta	DL	Cincinnati	CVG	154,658	121,126	103,660	103,660	103,944	69,012	9,200						0	-
Independence Air	DH	Washington Dulles	IAD						40,524							0	-
jetBlue	B6	New York J F Kennedy	JFK							119,872	178,914	179,850	178,129	128,936	135,379	6,443	5.0%
jetBlue	B6	Orlando	MCO									29,614	28,629	21,214	21,344	130	0.6%
Northwest	NW	Detroit	DTW	52,105	70,929	45,800	36,800	36,800	42,700	61,157	30,700					0	-
Trans World Airlines	TW	Hartford	BDL	43,310												0	-
United	UA	Chicago O'Hare	ORD	88,996	77,723											0	-
United	UA	Manchester	MHT	53,802	35,721											0	-
US Airways	US	Charlotte	CLT										10,736	48,688	47,130	(1,558)	(3.2%)
US Airways	US	Philadelphia	PHL	163,051	181,329	149,318	179,229	37,687	19,404						21,525	21,525	-
US Airways	US	Pittsburgh	PIT	137,472	141,080	133,590	23,552									0	-
US Airways	US	Washington National	DCA					7,936	6,668							0	-
Subtotal				797,338	738,636	536,028	454,576	290,311	239,537	190,229	289,325	362,984	375,404	389,224	474,876	85,651	22.0%
Regional/Commuter Carriers																	
Air Canada Express	AC	Montreal Dorval	YUL	4,734	6,269											0	-
Air Canada Express	AC	Toronto	YYZ											9,142	14,872	5,730	62.7%
America West	HP	New York Newark	EWR	2,457												0	-
American Eagle	AA	Boston	BOS	125,518	75,204	55,457	12,580	3,932								0	-
American Eagle	AA	Chicago O'Hare	ORD		17,289	33,557	33,792	40,456								0	-
American Eagle	AA	New York La Guardia	LGA	67,084	65,442	35,525	30,746	25,672								0	-
Continental Connection	CO	Albany	ALB		9,636	21,212	22,786	24,097	5,537							0	-
Continental Connection	CO	Boston	BOS	3,871	28,372				4,576							0	-
Continental Connection	CO	New York Newark	EWR									53,164	104,509	105,503	99,361	(6,142)	(5.8%)
Continental Connection	CO	Presque Isle	PQI		570											0	-
Continental Express	CO	Cleveland	CLE	20,378	25,606	9,176	6,700	6,757	11,021	10,493	11,197	16,193	13,786	9,400	9,400	0	0.0%
Continental Express	CO	New York Newark	EWR	70,393	63,715	70,587	67,610	70,061	69,605	71,007	71,921	36,831	657	200	4,150	3,950	1975.0%
Delta Connection	DL	Atlanta	ATL						48,440	95,820	73,880	54,724	51,970	25,532		(25,532)	(100.0%)
Delta Connection	DL	Boston	BOS		20,544	56,798	70,334	69,924	57,650							0	-
Delta Connection	DL	Cincinnati	CVG		3,050	6,000		9,200	31,166	47,966	47,813	35,463				0	-
Delta Connection	DL	Detroit	DTW											62,320	65,686	3,366	5.4%
Delta Connection	DL	New York J F Kennedy	JFK							16,143	64,967	65,560	64,286	13,500		(13,500)	(100.0%)
Delta Connection	DL	New York La Guardia	LGA	15,191	24,512	38,334	54,750	54,900	54,750	50,014	29,243			41,440	57,437	15,996	38.6%
Independence Air	DH	Washington Dulles	IAD					59,864	69,186	4,650						0	-
Lufthansa German Airlines	LH	Washington Dulles	IAD	1,550												0	-
Northwest Airlink	NW	Detroit	DTW	33,366	5,392	19,550	43,832	57,748	53,132	17,039	30,613	61,181	61,251			0	-
Northwest Airlink	NW	Minneapolis	MSP			1,093	7,064	22,057	20,186	4,550	6,100	6,100	1,500			0	-
Starlink Aviation	Q4	Yarmouth	YQI										7,071	9,386	9,386	0	0.0%
Swissair	SR	Boston	BOS	1,023												0	-
United Express	UA	Chicago O'Hare	ORD		12,200	54,750	67,000	73,200	67,590	87,660	85,347	82,719	82,662	82,273	72,457	(9,816)	(11.9%)
United Express	UA	Washington Dulles	IAD	49,779	48,750	65,450	55,850	67,100	83,730	92,899	70,940	68,020	67,831	64,767	62,493	(2,274)	(3.5%)
US Airways Express	US	Bangor	BGR	8,558	9,238	424										0	-
US Airways Express	US	Boston	BOS	42,359	40,311	14,362	4,615									0	-
US Airways Express	US	Charlotte	CLT					9,643	23,710	30,942	31,390	46,129	32,987	5,323	1,364	(3,959)	(74.4%)
US Airways Express	US	New York La Guardia	LGA	43,901	44,651	42,640	44,009	45,007	77,909	89,773	84,304	94,419	93,079	78,477	68,755	(9,722)	(12.4%)
US Airways Express	US	Philadelphia	PHL				3,050	68,684	100,307	113,072	121,427	124,630	134,837	133,521	129,133	(4,389)	(3.3%)
US Airways Express	US	Pittsburgh	PIT				24,200	43,103	10,971							0	-
US Airways Express	US	Plattsburgh	PLB	909												0	-
US Airways Express	US	Presque Isle	PQI				2,497	2,470								0	-
US Airways Express	US	Washington National	DCA	33,976	35,453	25,954	44,564	49,207	75,568	77,587	85,732	95,623	78,421	83,302	87,190	3,888	4.7%
US Airways Express	US	Westchester County	HPN	1,235												0	-
Subtotal				526,282	536,204	550,870	595,979	803,084	865,033	809,613	814,876	840,756	794,848	724,086	681,682	(42,404)	(5.9%)
Total				1,323,619	1,274,840	1,086,898	1,050,555	1,093,395	1,104,570	999,842	1,104,200	1,203,740	1,170,251	1,113,310	1,156,558	43,248	3.9%

Source: OAG Schedules.

Note: All Northwest operations included in Delta from 2010 onwards

Table F-7 Scheduled Passenger Operations by Market and Carrier for Burlington International Airport

				Departures													
Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																	
AirTran	FL	Baltimore	BWI									512	609			0	-
Continental	CO	New York Newark	EWR					4								0	-
jetBlue	B6	New York J F Kennedy	JFK	244	730	730	782	1,094	1,126	1,460	1,495	1,477	1,500	1,434	1,405	(29)	(2.0%)
jetBlue	B6	Orlando	MCO									361	317	330	339	9	2.6%
Northwest	NW	Detroit	DTW					214	174							0	-
United	UA	Chicago O'Hare	ORD	815	862	730	454	401	365	426	652	632	90			0	-
United	UA	Portland (ME)	PWM		61											0	-
US Airways	US	Philadelphia	PHL	1,098	1,095	1,126	338	366	365	365	181					0	-
US Airways	US	Pittsburgh	PIT	732	730	699										0	-
US Airways	US	Washington National	DCA						4							0	-
Subtotal				2,889	3,478	3,285	1,574	2,079	2,035	2,251	2,328	2,982	2,516	1,764	1,744	(20)	(1.2%)
Regional/Commuter Carriers																	
America West	HP	New York Newark	EWR	166												0	-
American Eagle	AA	Boston	BOS	3,094	1,855											0	-
American Eagle	AA	Chicago O'Hare	ORD			490	180									0	-
Continental Connection	CO	Albany	ALB		287	970	652	541								0	-
Continental Connection	CO	Boston	BOS	244	1,714	44			634	982	208					0	-
Continental Connection	CO	Buffalo	BUF	4	26											0	-
Continental Connection	CO	Hartford	BDL		129											0	-
Continental Connection	CO	New York Newark	EWR									573	973	405	975	570	140.5%
Continental Connection	CO	Plattsburgh	PLB	213	2,127	617	521	423	367	582	177					0	-
Continental Connection	CO	Plattsburgh International	PBG								31					0	-
Continental Connection	CO	Poughkeepsie	POU	66	521											0	-
Continental Connection	CO	Westchester County	HPN		26			17								0	-
Continental Express	CO	Cleveland	CLE	322	352	330	422	493	509	540	614	615	370	366	348	(17)	(4.7%)
Continental Express	CO	New York Newark	EWR	1,458	1,643	1,369	1,360	1,407	1,455	1,447	1,451	882	457	1,020	450	(570)	(55.9%)
Continental Express	CO	Westchester County	HPN				9									0	-
Delta Connection	DL	Atlanta	ATL						62	699	616	506	304			0	-
Delta Connection	DL	Boston	BOS		1,548	1,460	1,582	1,098	1,002		244	120				0	-
Delta Connection	DL	Cincinnati	CVG		552	1,095	1,095	1,098	1,060	651	365	152				0	-
Delta Connection	DL	Detroit	DTW											1,227	1,309	82	6.7%
Delta Connection	DL	New York J F Kennedy	JFK							582	1,364	1,251	1,182	1,336	1,338	2	0.2%
Delta Connection	DL	New York La Guardia	LGA	355	124											0	-
Independence Air	DH	Washington Dulles	IAD					977	1,903	93						0	-
Lufthansa German Airlines	LH	Washington Dulles	IAD	31												0	-
Northwest Airlink	NW	Detroit	DTW		722	1,087	1,353	1,173	1,159	1,086	866	824	883			0	-
Northwest Airlink	NW	Minneapolis	MSP					13	61	62	92	92				0	-
Porter Airlines	PD	Toronto Island Apt	YTZ												9	9	-
Swissair	SR	Boston	BOS	31												0	-
United Express	UA	Chicago O'Hare	ORD				698	966	1,003	964	730	618	1,097	1,353	1,565	212	15.7%
United Express	UA	Washington Dulles	IAD	1,477	1,460	1,460	1,399	1,464	1,456	1,456	1,403	1,312	1,196	1,130	1,112	(17)	(1.5%)
US Airways Express	US	Boston	BOS	2,404	1,616	637										0	-
US Airways Express	US	Charlotte	CLT							4		13				0	-
US Airways Express	US	New York La Guardia	LGA	2,074	1,673	1,687	1,812	2,200	2,175	2,382	2,275	2,184	2,154	1,680	1,487	(193)	(11.5%)
US Airways Express	US	Philadelphia	PHL				1,314	1,224	1,980	1,686	1,749	2,087	1,894	1,903	1,956	53	2.8%
US Airways Express	US	Pittsburgh	PIT		205	304	668	675								0	-
US Airways Express	US	Plattsburgh	PLB	2,427												0	-
US Airways Express	US	Poughkeepsie	POU	718												0	-
US Airways Express	US	Saranac Lake	SLK	44												0	-
US Airways Express	US	Washington National	DCA	988	812	865	1,047	1,024	990	999	1,095	1,224	1,078	1,043	1,043	0	0.0%
US Airways Express	US	Wilkes-Barre Scranton	AVP	22												0	-
Subtotal				16,138	17,390	12,414	14,113	14,794	15,816	14,215	13,280	12,453	11,587	11,461	11,593	132	1.1%
Total				19,028	20,868	15,699	15,686	16,873	17,851	16,466	15,607	15,435	14,103	13,225	13,336	111	0.8%

				Departing Seats													
Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																	
AirTran	FL	Baltimore	BWI									59,887	71,253			0	-
Continental	CO	New York Newark	EWR					531								0	-
jetBlue	B6	New York J F Kennedy	JFK	39,528	118,260	118,260	126,730	170,597	173,920	221,784	224,759	217,650	219,750	180,286	163,839	(16,447)	(9.1%)
jetBlue	B6	Orlando	MCO									41,121	37,700	33,014	33,871	857	2.6%
Northwest	NW	Detroit	DTW					21,400	17,429							0	-
United	UA	Chicago O'Hare	ORD	105,509	113,504	96,537	59,145	51,286	42,379	54,754	79,331	77,707	11,031			0	-
United	UA	Portland (ME)	PWM		7,808											0	-
US Airways	US	Philadelphia	PHL	150,338	145,596	144,205	43,264	46,848	46,170	44,089	21,720					0	-
US Airways	US	Pittsburgh	PIT	103,568	102,444	91,825										0	-
US Airways	US	Washington National	DCA						558							0	-
Subtotal				398,943	487,612	450,827	229,139	290,663	280,456	320,627	325,810	396,366	339,734	213,300	197,710	(15,590)	(7.3%)
Regional/Commuter Carriers																	
America West	HP	New York Newark	EWR	7,889												0	-
American Eagle	AA	Boston	BOS	102,111	61,215											0	-
American Eagle	AA	Chicago O'Hare	ORD			21,901	7,920									0	-
Continental Connection	CO	Albany	ALB		5,456	18,425	12,396	10,284								0	-
Continental Connection	CO	Boston	BOS	4,628	32,571	828			12,054	18,658	3,947					0	-
Continental Connection	CO	Buffalo	BUF	84	491											0	-
Continental Connection	CO	Hartford	BDL		2,443											0	-
Continental Connection	CO	New York Newark	EWR									42,423	71,981	30,002	72,161	42,159	140.5%
Continental Connection	CO	Plattsburgh	PLB	4,039	40,405	11,726	9,904	8,037	6,970	11,061	3,358					0	-
Continental Connection	CO	Plattsburgh International	PBG								589					0	-
Continental Connection	CO	Poughkeepsie	POU	1,262	9,894											0	-
Continental Connection	CO	Westchester County	HPN		494			331								0	-
Continental Express	CO	Cleveland	CLE	16,064	17,086	16,288	20,990	24,145	25,351	26,993	28,485	29,662	18,493	18,286	17,421	(864)	(4.7%)
Continental Express	CO	New York Newark	EWR	70,203	78,296	67,410	67,189	70,028	72,707	72,343	71,370	43,593	22,857	51,000	22,514	(28,486)	(55.9%)
Continental Express	CO	Westchester County	HPN				322									0	-
Delta Connection	DL	Atlanta	ATL						3,100	34,971	33,597	35,430	21,280			0	-
Delta Connection	DL	Boston	BOS		49,536	46,720	50,624	45,072	50,100		4,636	2,280				0	-
Delta Connection	DL	Cincinnati	CVG		17,664	48,270	54,750	54,900	52,979	31,567	18,250	7,600				0	-
Delta Connection	DL	Detroit	DTW											61,417	65,443	4,026	6.6%
Delta Connection	DL	New York J F Kennedy	JFK							24,144	62,901	62,536	59,741	67,071	81,259	14,189	21.2%
Delta Connection	DL	New York La Guardia	LGA	11,351	3,968											0	-
Independence Air	DH	Washington Dulles	IAD					48,829	95,136	4,650						0	-
Lufthansa German Airlines	LH	Washington Dulles	IAD	1,550												0	-
Northwest Airlink	NW	Detroit	DTW		36,093	54,329	72,303	62,125	61,983	63,533	43,279	41,200	44,150			0	-
Northwest Airlink	NW	Minneapolis	MSP					657	3,050	3,100	4,600	4,600				0	-
Porter Airlines	PD	Toronto Island Apt	YTZ												620	620	-
Swissair	SR	Boston	BOS	1,023												0	-
United Express	UA	Chicago O'Hare	ORD				34,900	48,314	59,930	67,500	49,266	40,519	70,569	84,431	88,435	4,004	4.7%
United Express	UA	Washington Dulles	IAD	73,843	71,110	73,000	69,950	73,200	72,786	72,779	71,925	67,065	63,217	61,988	69,793	7,805	12.6%
US Airways Express	US	Boston	BOS	48,139	59,797	23,580										0	-
US Airways Express	US	Charlotte	CLT							221		657				0	-
US Airways Express	US	New York La Guardia	LGA	76,749	61,896	62,403	67,060	81,400	80,491	88,123	84,175	80,792	79,703	62,144	55,008	(7,136)	(11.5%)
US Airways Express	US	Philadelphia	PHL				65,107	60,830	97,288	88,078	95,885	122,571	117,257	128,140	131,727	3,587	2.8%
US Airways Express	US	Pittsburgh	PIT		6,163	9,120	33,400	33,771								0	-
US Airways Express	US	Plattsburgh	PLB	46,116												0	-
US Airways Express	US	Poughkeepsie	POU	13,639												0	-
US Airways Express	US	Saranac Lake	SLK	841												0	-
US Airways Express	US	Washington National	DCA	31,574	33,714	25,954	44,681	51,200	61,458	58,184	70,278	80,423	65,756	77,625	82,974	5,349	6.9%
US Airways Express	US	Wilkes-Barre Scranton	AVP	415												0	-
Subtotal				511,521	588,291	479,952	611,497	673,123	755,382	665,906	646,539	661,351	635,004	642,104	687,357	45,253	7.0%
Total				910,464	1,075,903	930,779	840,636	963,785	1,035,838	986,532	972,349	1,057,717	974,739	855,404	885,067	29,663	3.5%

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-8 Scheduled Passenger Operations by Market and Carrier for Bangor International Airport

Departures

Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																	
Allegiant Air	G4	Sanford	SFB								17	109	160	181	150	(31)	(17.1%)
Allegiant Air	G4	St. Petersburg/Clearwater	PIE										12	107	93	(14)	(13.1%)
Pan American Airways	PN	Allentown/Bethlehem	ABE		298											0	-
Pan American Airways	PN	Baltimore	BWI		31	303										0	-
Pan American Airways	PN	Pittsburgh	PIT	285	140											0	-
Pan American Airways	PN	Portsmouth	PSM	389	247	303	178									0	-
Pan American Airways	PN	Sanford	SFB				17									0	-
Subtotal				674	716	607	195	0	0	0	17	109	172	288	243	(45)	(15.6%)
Regional/Commuter Carriers																	
American Eagle	AA	Boston	BOS	4,670	3,461	2,731	2,242	1,722	1,530	1,491	1,046					0	-
American Eagle	AA	New York La Guardia	LGA	382	396	457	427	428	518	409	339					0	-
Boston-Maine Airways	E9	Halifax	YHZ				340	4								0	-
Boston-Maine Airways	E9	Manchester	MHT				258	22								0	-
Boston-Maine Airways	E9	Portsmouth	PSM				295									0	-
Boston-Maine Airways	E9	Saint John	YSJ				90									0	-
Continental Connection	CO	Albany	ALB			401	652	575	189							0	-
Continental Express	CO	New York Newark	EWR						481	563	440	549	407			0	-
Delta Connection	DL	Atlanta	ATL							214	509	274				0	-
Delta Connection	DL	Boston	BOS		704	1,884	1,464	1,473	1,416	1,038	1,401	1,092	555			0	-
Delta Connection	DL	Cincinnati	CVG	1,342	1,095	1,095	1,161	1,464	1,394	678	695	125				0	-
Delta Connection	DL	Detroit	DTW											975	871	(104)	(10.7%)
Delta Connection	DL	New York J F Kennedy	JFK									341	942	180		(180)	(100.0%)
Delta Connection	DL	New York La Guardia	LGA											537	844	307	57.2%
Northwest Airlink	NW	Boston	BOS	27												0	-
Northwest Airlink	NW	Detroit	DTW				525	968	1,012	822	822	820	730			0	-
Northwest Airlink	NW	Minneapolis	MSP					13	61	13	13	13	13			0	-
Pan American Airways	PN	Portsmouth	PSM			79	27									0	-
Pan American Airways	PN	Saint John	YSJ			79	27									0	-
US Airways Express	US	Boston	BOS	1,942	1,371	270										0	-
US Airways Express	US	New York La Guardia	LGA	35	13	92	171	92	158	135	126	272	713	1,017	1,230	213	20.9%
US Airways Express	US	Philadelphia	PHL	428	608	511	1,032	1,072	1,179	1,125	1,077	1,085	1,126	1,156	1,405	249	21.5%
US Airways Express	US	Pittsburgh	PIT				153									0	-
US Airways Express	US	Portland (ME)	PWM	231	356	147										0	-
US Airways Express	US	Presque Isle	PQI	299												0	-
US Airways Express	US	Washington National	DCA				13					13	22	31	52	22	70.6%
Subtotal				9,357	8,005	7,745	8,875	7,833	7,937	6,488	6,470	4,583	4,508	3,896	4,402	506	13.0%
Total				10,031	8,720	8,352	9,071	7,833	7,937	6,488	6,487	4,692	4,680	4,184	4,645	461	11.0%

Departing Seats

Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																	
Allegiant Air	G4	Sanford	SFB								2,614	16,350	24,000	27,150	22,500	(4,650)	(17.1%)
Allegiant Air	G4	St. Petersburg/Clearwater	PIE										1,800	16,050	13,950	(2,100)	(13.1%)
Pan American Airways	PN	Allentown/Bethlehem	ABE		44,636											0	-
Pan American Airways	PN	Baltimore	BWI		4,650	45,514										0	-
Pan American Airways	PN	Pittsburgh	PIT	42,729	21,021											0	-
Pan American Airways	PN	Portsmouth	PSM	58,414	37,029	45,514	26,764									0	-
Pan American Airways	PN	Sanford	SFB				2,550									0	-
Subtotal				101,143	107,336	91,029	29,314	0	0	0	2,614	16,350	25,800	43,200	36,450	(6,750)	(15.6%)
Regional/Commuter Carriers																	
American Eagle	AA	Boston	BOS	154,115	114,559	98,201	86,533	64,063	56,594	56,193	38,697					0	-
American Eagle	AA	New York La Guardia	LGA	12,606	15,754	16,909	15,799	15,836	19,166	15,122	12,538					0	-
Boston-Maine Airways	E9	Halifax	YHZ				6,120	80								0	-
Boston-Maine Airways	E9	Manchester	MHT				4,636	399								0	-
Boston-Maine Airways	E9	Portsmouth	PSM				5,318									0	-
Boston-Maine Airways	E9	Saint John	YSJ				1,628									0	-
Continental Connection	CO	Albany	ALB			7,616	12,383	10,928	3,583							0	-
Continental Express	CO	New York Newark	EWR						22,698	23,928	17,541	25,607	20,343			0	-
Delta Connection	DL	Atlanta	ATL							14,980	35,650	19,160				0	-
Delta Connection	DL	Boston	BOS		22,528	60,288	47,391	60,375	70,800	51,339	34,332	44,102	27,764			0	-
Delta Connection	DL	Cincinnati	CVG	67,100	54,750	55,970	72,189	87,840	82,439	35,299	34,764	6,271				0	-
Delta Connection	DL	Detroit	DTW											50,540	54,640	4,100	8.1%
Delta Connection	DL	New York J F Kennedy	JFK									17,029	47,100	9,000		(9,000)	(100.0%)
Delta Connection	DL	New York La Guardia	LGA											26,958	49,368	22,410	83.1%
Northwest Airlink	NW	Boston	BOS	797												0	-
Northwest Airlink	NW	Detroit	DTW				26,264	54,207	55,222	42,848	41,100	40,979	36,500			0	-
Northwest Airlink	NW	Minneapolis	MSP					657	3,050	657	657	657	887			0	-
Pan American Airways	PN	Portsmouth	PSM			1,419	478									0	-
Pan American Airways	PN	Saint John	YSJ			1,419	478									0	-
US Airways Express	US	Boston	BOS	36,906	42,548	5,130										0	-
US Airways Express	US	New York La Guardia	LGA	1,295	486	3,036	8,529	4,600	7,914	6,757	6,321	13,579	27,763	44,051	53,371	9,321	21.2%
US Airways Express	US	Philadelphia	PHL	15,836	19,283	20,455	32,804	53,593	58,943	56,271	60,830	59,611	58,735	68,510	89,548	21,039	30.7%
US Airways Express	US	Pittsburgh	PIT				7,650									0	-
US Airways Express	US	Portland (ME)	PWM	8,558	12,689	4,842										0	-
US Airways Express	US	Presque Isle	PQI	6,224												0	-
US Airways Express	US	Washington National	DCA				657					657	1,093	1,529	2,607	1,079	70.6%
Subtotal				303,436	282,597	275,286	328,857	352,577	380,408	303,395	282,430	227,651	220,186	200,587	249,535	48,948	24.4%
Total				404,579	389,933	366,315	358,171	352,577	380,408	303,395	285,044	244,001	245,986	243,787	285,985	42,198	17.3%

Source: OAG Schedules; U.S. DOT, T100 Database.

Notes: Finnair scheduled technical stop (to Fort Lauderdale) in 2000 and Flyglobespan scheduled technical stops (on route to Sanford) in 2007 and 2008 not included

Allegiant stopped reporting to the OAG in 2009, so Allegiant 2009-2011 statistics from the T100 database.

All Northwest operations included in Delta from 2010 onwards

Table F-9 Scheduled Passenger Operations by Market and Carrier for Tweed-New Haven Airport

Carrier	Code	Market	Code	Departures 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	Departing Seats 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Regional/ Commuter Carriers																															
Delta Connection	DL	Cincinnati	CVG					642	1,025							0	-					32,100	51,236							0	-
Boston-Maine Airways	E9	Baltimore	BWI								279					0	-								5,025					0	-
Boston-Maine Airways	E9	Bedford	BED								113					0	-								2,029					0	-
Boston-Maine Airways	E9	Elmira/Corning	ELM								152					0	-								2,739					0	-
Boston-Maine Airways	E9	Portsmouth	PSM								57					0	-								1,021					0	-
US Airways Express	US	Philadelphia	PHL	1,773	1,773	1,486	1,452	1,372	1,904	2,051	1,703	1,634	1,586	1,608	1,535	(73)	(4.5%)	65,612	65,596	54,977	53,724	50,780	76,208	77,742	63,183	60,726	59,017	59,491	56,806	(2,685)	(4.5%)
US Airways Express	US	Washington National	DCA	937	600											0	-	34,658	22,200											0	-
Total				2,710	2,373	1,486	1,452	2,014	2,929	2,051	2,304	1,634	1,586	1,608	1,535	(73)	(4.5%)	100,270	87,796	54,977	53,724	82,880	127,444	77,742	73,996	60,726	59,017	59,491	56,806	(2,685)	(4.5%)

Source: OAG Schedules.

Table F-10 Scheduled Passenger Operations by Market and Carrier for Worcester Regional Airport

Carrier	Code	Market	Code	Departures 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	Departing Seats 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																															
Allegiant Air	G4	Sanford	SFB							182						-	-							27,343						-	-
Boston-Maine Airways	PN	Allentown/Bethlehem	ABE			111										-	-			16,693										-	-
Boston-Maine Airways	PN	Portsmouth	PSM		223	111										-	-		33,471	16,693										-	-
Boston-Maine Airways	PN	Sanford	SFB		284											-	-		42,621											-	-
Direct Air	D1/VX/X	Myrtle Beach	MYR										63	73	96	23	31.5%										8,743	9,782	14,120	4,338	44.3%
Direct Air	D1/VX/X	Orlando/Sanford	SFB									17	140	144	148	4	2.8%									2,533	19,809	21,937	24,339	2,402	10.9%
Direct Air	D1/VX/X	Punta Gorda	PGD									17	67	94	105	11	11.7%									2,533	9,569	14,541	17,287	2,746	18.9%
Direct Air	D1/VX/X	West Palm Beach	PBI											13	51	38	292.3%											1,872	7,444	5,572	297.6%
Subtotal				0	507	223	0	0	0	182	0	34	270	324	400	76	23.5%	0	76,093	33,386	0	0	0	27,343	0	5,066	38,121	48,132	63,190	15,058	31.3%
Regional/Commuter Carriers																															
American Eagle	AA	Chicago O'Hare	ORD		368	333										0	-		15,889	15,424										0	-
American Eagle	AA	New York J F Kennedy	JFK	552	666											0	-	18,216	21,978											0	-
Delta Connection	DL	Atlanta	ATL	670	865	304										0	-	33,500	43,271	15,200										0	-
US Airways Express	US	Philadelphia	PHL	1,464	1,382	1,043	257									0	-	54,168	51,118	38,369	9,514									0	-
Subtotal				2,686	3,281	1,680	257	0	0	0	0	0	0	0	0	0	-	105,884	132,257	68,993	9,514	0	0	0	0	0	0	0	0	0	-
Total				2,686	3,788	1,902	257	0	0	182	0	34	270	324	400	76	23.5%	105,884	208,349	102,379	9,514	0	0	27,343	0	5,066	38,121	48,132	63,190	15,058	31.3%

Sources: OAG Schedules; U.S. DOT, T100 Database.

Note: As Direct Air schedule not published in the OAG, all Direct Air statistics from the T100 database. Direct Air flights operated by Xtra Airways, Vision Airlines, Sky King, Casino Express, USA Jet, Miami Air and Falcon Air Express.

Table F-11 Scheduled Passenger Operations by Market and Carrier for Hanscom Field

				Departures														Departing Seats													
Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Regional/Commuter Carriers																															
Boston-Maine Airways	E9	Elmira/Corning								131	389					0	-							2,366	6,994					-	-
Boston-Maine Airways	E9	Hyannis	HYA				9									0	-				159									-	-
Boston-Maine Airways	E9	Manchester	MHT				157									0	-				2,823									-	-
Boston-Maine Airways	E9	Martha's Vineyard	MVY				4									0	-				72									-	-
Boston-Maine Airways	E9	Nantucket	ACK				148									0	-				2,669									-	-
Boston-Maine Airways	E9	New Haven	HVN								113					0	-								2,029					-	-
Boston-Maine Airways	E9	New London/Groton	GON					61	9							0	-					1,101	159							-	-
Boston-Maine Airways	E9	Portsmouth	PSM				157	336	193	254	221	26				0	-				2,818	6,051	3,482	4,569	3,975	463				-	-
Boston-Maine Airways	E9	Trenton	TTN					987	867	992	1,047	26				0	-					17,763	15,606	17,859	18,841	463				-	-
Pan American Airways	PN	Atlantic City Pomona Field	ACY			9										0	-			154										-	-
Pan American Airways	PN	Martha's Vineyard	MVY			13	4									0	-			234	80									-	-
Pan American Airways	PN	New York Newark	EWR			92										0	-			1,656										-	-
Pan American Airways	PN	Portsmouth	PSM			337	97									0	-			6,061	1,754									-	-
Pan American Airways	PN	Westchester County	HPN			224	106									0	-			4,027	1,913									-	-
Shuttle America	S5	Buffalo	BUF	1,119	980											0	-	55,950	47,625											-	-
Shuttle America	S5	Hartford	BDL	173												0	-	8,636												-	-
Shuttle America	S5	New York La Guardia	LGA	523	854											0	-	26,143	42,707											-	-
Shuttle America	S5	Trenton	TTN	2,062	1,829		196	43								0	-	103,093	88,737		6,482	1,414								-	-
Streamline	xx	Trenton	TTN												155	155	-												4,650	4,650	-
US Airways	US	Martha's Vineyard	MVY			53										0	-			1,740										-	-
US Airways	US	Nantucket	ACK			35										0	-			1,160										-	-
US Airways	US	New York La Guardia	LGA			716										0	-			23,707										-	-
US Airways	US	Philadelphia	PHL		279	1,439										0	-		10,318	48,023										-	-
US Airways	US	Trenton	TTN		340	2,094	1,621	734								0	-		12,575	69,691	53,488	24,213								-	-
US Airways	US	Westchester County	HPN			337										0	-			11,135										-	-
Total				3,876	4,282	5,348	2,500	2,161	1,069	1,377	1,769	51	0	0	155	155	-	193,821	201,962	167,588	72,259	50,541	19,247	24,794	31,839	926	0	0	4,650	4,650	-

Source: OAG Schedules.

Table F-12 Scheduled Passenger Operations by Market and Carrier for Portsmouth International Airport

				Departures														Departing Seats													
Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																															
Allegiant Airways	G4	Orlando/Sanford	SFB						35	191	43					-	-						5,229	28,671	6,471					-	-
Boston-Maine Airways	E9	Fort Lauderdale/Hollywood	FLL					9	13							-	-					1,329	1,993							-	-
Boston-Maine Airways	E9	Hartford	BDL						13							-	-						1,993							-	-
Boston-Maine Airways	E9	Newburgh	SWF						48							-	-						7,179							-	-
Boston-Maine Airways	E9	Sanford	SFB					57	57							-	-					8,507	8,593							-	-
Pan American Airways	PN	Allentown/Bethlehem	ABE	93	215											-	-	13,950	32,207											-	-
Pan American Airways	PN	Bangor	BGR	389	247	303	174									-	-	58,414	37,029	45,514	26,164									-	-
Pan American Airways	PN	Gary	GYY	51												-	-	7,714												-	-
Pan American Airways	PN	Manchester	MHT				17	170								-	-				2,614	25,543								-	-
Pan American Airways	PN	New York Newark	EWR			31										-	-			4,650										-	-
Pan American Airways	PN	Pittsburgh	PIT	261												-	-	39,171												-	-
Pan American Airways	PN	Sanford	SFB	296	299	286	271	261								-	-	44,400	44,914	42,943	40,629	39,107								-	-
Pan American Airways	PN	Santo Domingo	SDQ			13										-	-			1,993										-	-
Pan American Airways	PN	St. Petersburg/Clearwater	PIE			65										-	-			9,707										-	-
Pan American Airways	PN	Worcester	ORH		254	111										-	-		38,121	16,693										-	-
Skybus	SX	Columbus	CMH								409	108				-	-								58,896	15,552				-	-
Skybus	SX	Greensboro	GSO									83				-	-									11,952				-	-
Skybus	SX	Punta Gorda	PGD								15	59				-	-								2,160	8,496				-	-
Skybus	SX	Saint Augustine	UST								14	56				-	-								2,016	8,064				-	-
Subtotal				1,091	1,015	810	463	497	167	191	481	306	0	0	0	0	-	163,650	152,271	121,500	69,407	74,486	24,986	28,671	69,543	44,064	0	0	0	0	-
Regional/Commuter Carriers																															
Boston-Maine Airways	E9	Baltimore	BWI				77									-	-				1,391						156			-	-
Boston-Maine Airways	E9	Bangor	BGR				235									-	-				4,222									-	-
Boston-Maine Airways	E9	Bedford	BED				272	420	171	223	221	9				-	-				4,904	7,552	3,083	4,014	3,975	154				-	-
Boston-Maine Airways	E9	Hyannis	HYA				96									-	-				1,731									-	-
Boston-Maine Airways	E9	Manchester	MHT				214	4								-	-				3,847	80								-	-
Boston-Maine Airways	E9	Martha's Vineyard	MVY				39	22								-	-				705	399								-	-
Boston-Maine Airways	E9	Nantucket	ACK				75	82								-	-				1,342	1,476								-	-
Boston-Maine Airways	E9	New Haven	HVN								57					-	-								1,021					-	-
Boston-Maine Airways	E9	New London/Groton	GON				166	217								-	-				2,988	3,901								-	-
Boston-Maine Airways	E9	Saint John	YSJ				466	173								-	-				8,385	3,111								-	-
Boston-Maine Airways	E9	Trenton	TTN						22							-	-						399							-	-
Boston-Maine Airways	E9	Westchester County	HPN				292	43								-	-				5,264	782								-	-
Pan American Airways	PN	Atlantic City Pomona Field	ACY			153										-	-			2,754										-	-
Pan American Airways	PN	Baltimore	BWI			44	22									-	-			784	399									-	-
Pan American Airways	PN	Bangor	BGR			79	27									-	-			1,419	478									-	-
Pan American Airways	PN	Bedford	BED			315	75									-	-			5,662	1,355									-	-
Pan American Airways	PN	Martha's Vineyard	MVY			153	9									-	-			2,754	159									-	-
Pan American Airways	PN	Saint John	YSJ			66	22									-	-			1,183	399									-	-
Subtotal				0	0	809	2,087	961	193	223	278	9	0	0	0	0	-	0	0	14,557	37,569	17,301	3,482	4,014	4,996	154	156	0	0	0	-
Total				1,091	1,015	1,619	2,550	1,458	360	414	759	315	0	0	0	0	-	163,650	152,271	136,057	106,976	91,786	28,467	32,685	74,540	44,218	156	0	0	0	-

Sources: OAG Schedules; U.S. DOT, T100 Database.
Note: Skybus did not report to the OAG, so all 2007 and 2008 Skybus statistics from the T100 database.

G

Ground Access

This appendix provides information in support of *Chapter 5, Ground Access to and from Logan Airport*:

- Table G-1 Logan Express Bus Service Ridership (Annual)
- Table G-2 Water Transportation Services Ridership (Annual)
- Table G-3 Massachusetts Bay Transportation Authority (MBTA) Airport Station Passengers
- Table G-4 Annual Taxi Dispatches
- Table G-5 Logan Airport Employee Parking Supply
- Table G-6 Logan Airport Commercial Parking Supply
- Table G-7 2011 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment, and Vehicle Miles Traveled (VMT) Summary
- VISSIM Traffic Roadway Network
- March 2011 Logan Airport Parking Space Inventory, submitted to Massachusetts Department of Environmental Protection (also known as the *Parking Freeze Report*)
- September 2011 Logan Airport Parking Space Inventory, submitted to Massachusetts Department of Environmental Protection (also known as the *Parking Freeze Report*)

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Table G-1 Logan Express Bus Service Ridership

	Ridership			Percent Change		
Service Year	Air Passengers	Employees	Total	Air Passengers	Employees	Total
Framingham						
1992	207,847	7,573	215,420	4.3%	21.3%	4.8%
1993	229,064	12,307	241,371	10.2%	62.5%	12.0%
1994	250,342	17,352	267,694	9.3%	41.0%	10.9%
1995	274,754	21,129	295,883	9.8%	21.8%	10.5%
1996	325,665	22,932	348,597	18.5%	8.5%	17.8%
1997	316,306	29,871	346,175	(2.9)%	30.3%	(0.7)%
1998	337,007	33,971	370,978	6.5%	13.7%	7.2%
1999	345,715	31,946	380,661	3.5%	(6.0)%	2.6%
2000	371,560	34,508	406,068	6.6%	8.0%	6.7%
2001	354,521	38,740	393,261	(4.6)%	12.3%	(3.2)%
2002	342,746	42,441	385,187	(3.3)%	8.7%	(2.1)%
2003	310,024	55,979	366,003	(9.5)%	31.9%	(5.0)%
2004	323,931	54,763	378,694	4.5%	(2.2%)	3.5%
2005	318,125	57,569	375,694	(1.8%)	5.1%	(0.8%)
2006	349,022	60,764	409,789	9.7%	5.5%	9.1%
2007	311,299	57,252	368,551	(2.1%)[5]	(0.6%)[5]	(1.9%)[5]
2008	276,112	57,797	333,909	(11.3%)	1.0%	(9.4%)
2009	264,233	59,840	324,073	(4.3%)	3.5%	(2.9%)
2010	272,190	62,226	334,416	3.0%	4.0%	3.2%
2011[1]	**272,301**	**68,228**	**340,529**	**0.0%**	**9.6%**	**1.8%**
Braintree						
1992	186,217	9,694	195,911	10.6%	16.6%	10.8%
1993	205,209	22,768	227,977	10.2%	134.9%	16.4%
1994	247,636	37,489	285,125	20.7%	64.7%	25.1%
1995	264,579	70,723	335,302	6.8%	88.7%	17.6%
1996	335,232	103,519	438,751	26.7%	46.4%	30.1%
1997	300,006	135,340	435,346	(10.5)%	30.7%	(0.8)%
1998	300,005	156,105	456,110	0.0%	15.3%	4.8%
1999	328,818	125,286	454,105	9.6%	(19.7)%	(0.5)%
2000	355,932	149,687	505,619	8.2%	19.5%	11.3%
2001	345,249	156,240	501,489	(3.0)%	4.4%	(0.8)%
2002	323,115	190,360	513,475	(6.4)%	21.8%	2.4%
2003	301,013	216,765	517,778	(6.8)%	13.9%	0.8%
2004	318,100	208,566	526,666	5.7%	(3.8%)	1.7%
2005	307,659	189,531	497,190	(3.2%)	(9.1%)	(5.5%)
2006	333,413	202,983	536,396	8.4%	7.1%	7.9%
2007	300,715	196,955	497,670	(2.3%)[5]	3.9%[5]	0.1%[5]
2008	252,289	221,591	473,880	(16.1%)	12.5%	(4.8%)
2009	231,151	234,908	466,059	(8.4%)	6.0%	(1.7%)
2010	231,422	251,443	482,865	0.1%	7.0%	3.6%
2011[1]	**233,521**	**285,515**	**519,036**	**0.9%**	**13.6%**	**7.5%**

Table G-1 Logan Express Bus Service Ridership (Continued)

	Ridership			Percent Change		
Service Year	**Air Passengers**	**Employees**	**Total**	**Air Passengers**	**Employees**	**Total**
Woburn[2]						
1992[3]	3,052	91	3,143	NA	NA	-
1993	59,635	5,027	64,662	NA	NA	-
1994	119,567	9,082	128,649	100.5%	80.7%	99.0%
1995	150,147	13,376	163,523	25.6%	47.3%	27.1%
1996	190,566	17,322	207,888	26.9%	29.5%	27.1%
1997	199,715	20,018	219,733	4.8%	15.6%	5.7%
1998	208,286	22,876	231,162	4.3%	14.3%	5.2%
1999	191,454	23,495	214,949	(8.1)%	2.7%	(7.0)%
2000	195,744	27,522	223,266	2.2%	17.1%	3.9%
2001	177,375	38,318	215,530	(9.4)%	39.2%	(3.4)%
2002	161,145	73,277	234,422	(9.2)%	91.0%	8.7%
2003	164,980	103,963	268,943	(2.4)%	41.9%	14.7%
2004	172,110	111,326	283,436	4.3%	7.1%	5.4%
2005	163,227	110,961	274,188	(5.1%)	(0.3%)	(3.2%)
2006	167,341	121,672	289,013	2.5%	9.7%	5.4%
2007	149,149	123,066	272,215	(8.6%)[5]	10.9%[5]	(0.7%)[5]
2008	129,385	122,777	252,162	(13.3%)	(0.2%)	(7.4%)
2009	113,607	121,633	235,240	(12.2%)	(0.9%)	(6.7%)
2010	115,257	127,120	242,377	1.5%	4.5%	3.0%
2011[1]	**118,232**	**151,029**	**269,261**	**2.6%**	**18.8%**	**11.1%**
Peabody						
2001[4]	8,151	3,097	11,248	NA	NA	NA
2002	28,626	20,629	49,255	NA	NA	NA
2003	32,318	23,425	55,743	21.4%	13.6%	13.2%
2004	43,389	33,642	77,031	34.3%	43.6%	38.2%
2005	51,023	39,599	87,622	17.6%	17.7%	13.7%
2006	42,142	32,632	74,774	(17.4%)	(17.6%)	(14.7%)
2007	36,367	26,949	63,316	(28.7%)[5]	(31.9%)[5]	(27.7%)[5]
2008	30,887	30,596	61,483	(15.1%)	13.5%	(2.9%)
2009	27,856	32,220	60,076	(9.8%)	5.3%	(2.3%)
2010	25,543	26,231	51,744	(8.3%)	(18.6%)	(13.8%)
2011[1]	**25,555**	**31,741**	**57,296**	**0.0%**	**21.0%**	**10.7%**

NA Not applicable.
1 Changes to employee parking and bus fares were implemented in October 2011.
2 Woburn Express moved from Mishawum Station to the Anderson Regional Transportation Center (ARTC) in Woburn in May 2001.
3 Reflects a partial year of operation; Woburn Logan Express service was implemented in November 1992.
4 Reflects a partial year of operation. The Peabody Logan Express service commenced in September 2001.
5 Percent comparison between 2007 and 2005. The I-90 Ted Williams Tunnel closures in 2006 resulted in atypical ridership.

Table G-1 Logan Express Bus Service Ridership (Continued)

	Ridership			Percent Change		
Service Year	**Air Passengers**	**Employees**	**Total**	**Air Passengers**	**Employees**	**Total**
Total System Ridership						
1992	397,116	17,358	414,474	8.0%	19.2%	8.5%
1993	493,908	39,832	533,740	24.4%	129.5%	28.8%
1994	617,545	63,923	681,468	25.0%	60.5%	27.7%
1995	689,480	105,228	794,708	11.6%	64.6%	16.6%
1996	851,463	143,773	995,236	23.4%	36.6%	25.2%
1997	816,015	185,229	1,001,254	(4.2)%	28.8%	0.6%
1998	845,598	212,952	1,058,550	3.6%	15.0%	5.7%
1999	868,987	180,727	1,049,714	2.7%	(15.2)%	(0.8)%
2000	923,236	211,717	1,134,953	6.2%	17.1%	8.1%
2001	885,296	236,395	1,121,691	(4.1)%	11.7%	(1.2)%
2002	855,632	326,707	1,182,339	(3.4)%	38.2%	5.4%
2003	808,335	400,132	1,208,467	(5.5%)	22.5%	2.2%
2004	857,530	408,297	1,265,827	6.1%	2.0%	2.2%
2005	837,034	397,660	1,234,694	(2.4%)	(2.6%)	(2.4%)
2006	891,918	418,051	1,309,969	6.6%	5.1%	6.1%
2007	797,530	404,222	1,201,752	(4.7%)[5]	1.7%[5]	(2.7%)[2]
2008	688,673	432,761	1,121,434	(13.6%)	7.1%	(6.7%)
2009	636,847	448,601	1,085,448	(7.5%)	3.7%	(3.2%)
2010	644,412	467,020	1,111,432	1.2%	4.1%	2.4%
2011[1]	**649,609**	**536,513**	**1,186,122**	**0.8%**	**14.9%**	**6.7%**

Source: Massport

1 Changes to employee parking and bus fares were implemented in October 2011.

2 Percent comparison between 2007 and 2005. The I-90 Ted Williams Tunnel closures in 2006 resulted in atypical ridership.

Table G-2 Water Transportation Services Ridership to and from Logan Airport

	Rowes Wharf/Fan Pier Water Shuttle	Private Water Taxi (on-demand)[1]	Harbor Express (Long Wharf/Quincy/Hull)	Boston-Logan Water Shuttle (Long Wharf)	Total
1990	181,530	NS	NS	NS	181,530
1991	142,500	NS	NS	NS	142,500
1992	133,297	NS	NS	NS	133,297
1993	159,525	NS	NS	NS	159,525
1994	209,057	NS	NS	NS	209,057
1995	203,829	NS	NS	NS	203,829
1996	159,992	3,364	11,781	NS	175,137
1997	132,542	6,299	71,309	NS	210,150
1998	124,836	9,243	101,174	NS	235,253
1999	122,211	17,252	98,539	NS	238,002
2000	128,097	26,335	83,243	NS	237,675
2001	107,400	29,642	82,704	NS	219,746
2002	75,304	36,736	66,471	NS	178,511
2003	26,480[2]	35,724[3]	61,849	5,722[4]	129,775
2004	NS	54,540	58,788	3,202[5]	116,530
2005	NS	44,975	51,960	NS	96,935
2006	NS	63,639	70,998	NS	134,637
2007	NS	50,737	59,460	NS	110,197
2008	NS	48,630	48,003	NS	96,633
2009	NS	50,734	37,861	NS	88,595
2010	NS	54,382	34,794	NS	89,176
2011	**NS**	**58,879**	**33,403**	**NS**	**92,282**

Source: Massport
Note: Figures from 2003 – 2007 have been revised from previous documents.
1 Operates April-October only.
2 Rowes Wharf Water Shuttle operated from January to June only in 2003.
3 Operated from May to October only in 2003.
4 Long Wharf Boston-Logan Water Shuttle operated from August to December in 2003.
5 Joint operation with City Water Taxi began on August 16, 2003.
NA Data not available.
NS Operation not in service.

Table G-3	Massachusetts Bay Transportation Authority (MBTA) Airport Station Passengers			
Year	**Entrances**	**Exits**	**Total Turnstile Count**[1]	**Percent Change**
1990	NA	NA	2,854,317	-
1991	NA	NA	2,515,293	(11.9)%
1992	NA	NA	2,626,572	4.2%
1993	NA	NA	2,604,980	(0.8)%
1994	NA	NA	3,108,734	19.3%
1995	NA	NA	3,040,868	(2.2)%
1996	NA	NA	2,974,850	(2.2)%
1997[2]	NA	NA	2,774,268	(6.7)%
1998	NA	NA	2,850,367	2.7%
1999	NA	NA	2,974,045	4.3%
2000	NA	NA	3,019,086	1.5%
2001	NA	NA	2,896,638	(4.1)%
2002	NA	NA	2,670,594	(7.8)%
2003[3]	1,300,272	1,275,627	2,575,899	(3.6)%
2004	1,373,861	1,366,511	2,740,372	6.4%
2005	NA	NA	NA	NA
2006	NA	NA	NA	NA
2007[4]	1,412,055	1,112,024	2,524,079	--
2008[4]	2,212,111	1,435,283	3,647,394	56.7%
2009	2,329,370	1,421,179	3,750,549	5.3%
2010	2,270,241	1,358,952	3,629,193	(2.5%)
2011	**2,277,311**	**NA**	**NA**	**0.3%**

Source: MBTA.
Note: Turnstile counts include both Logan Airport bound (turnstile exits) and non-Logan Airport bound (turnstile entrances) passengers.
1 As stated in the *Logan Airport 1999 ESPR*, Massport believes that ridership estimates through 2005 from the old Airport Station were actually understated because many travelers that were destined for the Airport with baggage had been observed to avoid the turnstiles and exit the old Airport Station via the wide gate (designed for handicapped access) that did not have the capability to count passengers.
2 Airport Station was closed on six weekends during September and October 1997 due to construction.
3 Airport Station was closed on eight weekend days during 2003.
4 Automated fare collection and new fare gates implemented beginning January 2007. Station access to Bremen Street Park opened June 2007. Exits are undercounted.
5 Exits are undercounted, as some exits occur through exit doors rather than turnstiles.
NA Data not available

Table G-4 Annual Taxi Dispatches

Year	Total	Percent Change
1990	1,330,418	-
1991	1,208,611	(9.2)%
1992	1,266,033	4.8%
1993	1,336,603	5.6%
1994	1,409,505	5.5%
1995	1,499,869	6.4%
1996	1,721,093	14.7%
1997	1,827,244	6.2%
1998	1,888,281	3.3%
1999	1,955,895	3.6%
2000	2,140,724	9.4%
2001	1,789,736	(16.4)%
2002	1,679,508	(6.2)%
2003	1,562,076	(7.0)%
2004	1,713,696	9.7%
2005	1,769,876	3.3%
2006	1,857,609	5.0%
2007	1,925,817	3.7%
2008	1,749,730	(9.1)%
2009	1,630,333	(6.8)%
2010	1,829,961	12.1%
2011	**1,937,743**	**6.0%**

Source: Previous EDR/ESPR Documentation.
Note: The available taxi data only reports dispatches from Logan Airport's taxi pool. The data do not include suburban or city taxis that drop passengers at Logan Airport and depart empty, as these companies are not required to provide their ridership statistics to Massport.

Table G-5 Logan Airport Employee Parking Supply

Location	Number of Spaces March 2010	September 2010	March 2011	September 2011
Terminal Area	884	779	**779**	**821**
North Service Area	777	815	**914**	**884**
Southwest Service Area	10	10	**0**	**0**
South Service Area	1,181	884	**894**	**893**
Airside (Fire/Rescue)	5	5	**5**	**5**
Total spaces in service	2,857	2,493	**2,592**	**2,603**
Total spaces out of service	511	880	**781**	**70**
Total employee spaces	3,373	3,373	**3,373**	**2,673**

Source: Logan Airport Parking Space Inventory submitted to Massachusetts Department of Environmental Protection (MassDEP), March and September 2011.
Note: As of April 2011, the Logan Airport Parking Freeze sets a limit of 18,019 commercial spaces and 2,673 employee spaces at the Airport.

Table G-6 Logan Airport Commercial Parking Supply

Location	Number of Spaces March 2010	September 2010	March 2011	September 2011
Terminal Area				
Central Garage and West Garage	10,375	10,375	**10,375**	**10,344**
Terminal B Garage	2,235	1,880	**2,380**	**1,644**
Terminal E Lot 1	269	269	**269**	**269**
Terminal E Lot 2	257	257	**257**	**257**
Terminal E Lot 3 (Gulf Lot)	175	229	**229**	**229**
Logan Airport Hilton	235	235	**235**	**235**
North Service Area				
Economy Lot 2	932	0	**n/a**	**n/a**
Economy Garage	n/a	n/a	**2,880**	**2,789**
Overflow Lot(s)	260	645	**250**	**0**
Signature (General Aviation)	35	35	**35**	**35**
South Service Area				
Harborside Hyatt Conference Center and Hotel	258	251	**270**	**270**
Southwest Service Area				
Former USPS Site (Lot 3)	416	416	**416**	**0**
Total spaces in service	15,447	14,592	**17,596**	**16,072**
Total spaces out of service	1,872	2,727	**23**	**1,947**
Total commercial spaces	17,319	17,319	**17,619**	**18,019**

Source: Logan Airport Parking Space Inventory submitted to MassDEP, March and September 2011.
Note: Logan Airport Parking Freeze sets a limit of 20,692 spaces on airport. As of April 6, 2011, the allocation is 18,019 commercial and 2,673 employee spaces.

Table G-7 2011 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary

			VOLUME				VMT			
Link Name	Link Distance (ft)	Link Speed (mph)	AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
1	344	22	689	902	6320	13775	45	59	412	898
2	496	23	783	1024	7176	15640	74	96	674	1469
3	1347	22	542	709	4967	10825	138	181	1267	2762
4	1166	26	687	899	6298	13727	152	199	1391	3031
5	378	25	1229	1608	11265	24552	88	115	807	1759
6	441	30	601	786	5508	12005	50	66	460	1003
7	896	22	626	818	5735	12499	106	139	974	2122
8	644	17	1026	1343	9407	20503	125	164	1148	2503
9	1214	7	245	321	2246	4895	56	74	516	1125
10	1655	25	743	972	6810	14843	233	305	2135	4652
11	1363	9	378	495	3467	7557	98	128	895	1951
12	2453	32	19	25	176	383	9	12	82	178
13	2043	23	47	62	432	941	18	24	167	364
14	750	19	1472	1926	13496	29415	209	274	1917	4178
15	441	24	825	1079	7564	16485	69	90	632	1376
16	106	23	106	139	973	2120	2	3	20	43
17	163	23	107	140	980	2136	3	4	30	66
20	252	5	11	15	102	223	1	1	5	11
21	127	15	36	47	329	717	1	1	8	17
22	74	5	11	15	102	223	0	0	1	3
23	507	25	211	277	1938	4225	20	27	186	406
24	179	25	188	245	1719	3747	6	8	58	127
25	126	25	26	33	234	510	1	1	6	12
26	121	5	10	13	88	191	0	0	2	4
27	101	22	26	33	234	510	1	1	4	10
29	119	22	10	13	88	191	0	0	2	4
30	74	25	9	11	80	175	0	0	1	2
31	94	7	10	13	88	191	0	0	2	3
32	261	31	24	31	219	478	1	2	11	24
33	79	12	6	8	59	128	0	0	1	2
34	185	12	50	66	461	1004	2	2	16	35
35	683	25	60	78	549	1196	8	10	71	155
36	667	33	34	45	315	686	4	6	40	87
37	433	25	49	64	446	973	4	5	37	80
38	387	33	34	45	315	686	2	3	23	50
39	84	11	113	148	1039	2264	2	2	17	36
40	217	23	113	148	1039	2264	5	6	43	93
42	151	5	10	13	88	191	0	0	3	5
44	132	16	51	67	468	1020	1	2	12	25
45	76	11	10	13	88	191	0	0	1	3
46	208	22	32	42	293	638	1	2	12	25
48	88	22	32	42	293	638	1	1	5	11
50	316	22	32	42	293	638	2	3	18	38
51	45	33	34	45	315	686	0	0	3	6
52	240	33	75	98	688	1499	3	4	31	68
53	446	33	76	99	695	1515	6	8	59	128
54	447	5	73	96	673	1467	6	8	57	124
55	145	5	73	96	673	1467	2	3	19	40
56	247	5	135	176	1236	2694	6	8	58	126
57	366	23	313	409	2867	6250	22	28	199	433
63	361	30	26	34	241	526	2	2	16	36
65	504	30	118	155	1083	2360	11	15	103	225
66	170	30	118	155	1083	2360	4	5	35	76

Table G-7 2011 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME AM Peak	VOLUME PM Peak	VOLUME High 8-Hour	VOLUME AWDT	VMT AM Peak	VMT PM Peak	VMT High 8-Hour	VMT AWDT
67	217	31	109	143	1002	2184	4	6	41	90
68	231	31	109	143	1002	2184	5	6	44	96
69	299	31	164	215	1507	3284	9	12	85	186
70	146	31	8	10	73	159	0	0	2	4
71	243	31	38	50	351	765	2	2	16	35
72	281	31	38	50	351	765	2	3	19	41
73	398	31	22	29	205	446	2	2	15	34
74	130	31	22	29	205	446	1	1	5	11
75	171	31	41	54	380	829	1	2	12	27
76	63	8	30	40	278	606	0	0	3	7
77	183	26	30	40	278	606	1	1	10	21
79	171	29	34	45	315	686	1	1	10	22
81	146	5	12	16	110	239	0	0	3	7
82	36	8	34	45	315	686	0	0	2	5
83	108	9	31	41	285	622	1	1	6	13
84	164	25	31	41	285	622	1	1	9	19
87	160	5	7	9	66	143	0	0	2	4
88	34	9	7	9	66	143	0	0	0	1
89	128	16	30	40	278	606	1	1	7	15
90	582	8	204	267	1873	4081	22	29	206	450
91	472	13	213	279	1953	4257	19	25	175	380
92	158	27	35	46	322	701	1	1	10	21
93	164	27	35	46	322	701	1	1	10	22
96	154	24	39	51	358	781	1	1	10	23
97	154	5	16	21	146	319	0	1	4	9
98	80	27	39	51	358	781	1	1	5	12
113	565	13	182	238	1668	3635	19	25	179	389
114	609	24	223	291	2041	4448	26	34	235	513
115	451	30	337	441	3087	6728	29	38	264	575
116	399	14	43	56	395	861	3	4	30	65
117	283	14	203	265	1858	4050	11	14	100	217
118	295	13	532	696	4879	10634	30	39	272	594
119	240	7	201	263	1843	4018	9	12	84	183
120	365	22	219	286	2004	4368	15	20	139	302
121	356	14	348	455	3189	6951	23	31	215	469
122	486	20	123	161	1127	2455	11	15	104	226
123	486	22	115	150	1053	2296	11	14	97	211
124	280	25	107	140	980	2136	6	7	52	113
125	280	22	103	135	944	2057	5	7	50	109
126	884	21	353	461	3233	7047	59	77	541	1179
127	1050	19	230	301	2107	4592	46	60	419	913
128	257	25	11	15	102	223	1	1	5	11
129	257	22	16	21	146	319	1	1	7	16
131	784	28	2	3	22	48	0	0	3	7
132	302	24	373	488	3416	7445	21	28	195	426
133	177	23	220	288	2019	4400	7	10	68	147
134	1521	24	365	477	3343	7286	105	137	963	2098
135	1542	23	227	298	2085	4544	66	87	609	1327
136	189	13	30	40	278	606	1	1	10	22
137	173	28	24	31	219	478	1	1	7	16
138	210	23	12	16	110	239	0	1	4	10

Table G-7 2011 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

			VOLUME				VMT			
Link Name	Link Distance (ft)	Link Speed (mph)	AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
139	248	26	36	47	329	717	2	2	15	34
140	369	23	270	353	2472	5389	19	25	173	377
141	265	23	230	301	2107	4592	12	15	106	231
142	192	22	340	445	3116	6792	12	16	113	247
143	272	22	272	356	2494	5437	14	18	129	280
144	518	7	196	257	1799	3922	19	25	176	384
145	195	28	110	144	1009	2200	4	5	37	81
146	463	28	108	141	988	2152	9	12	87	189
147	230	28	290	379	2655	5787	13	17	116	252
148	794	28	93	122	856	1865	14	18	129	280
149	661	22	108	141	988	2152	14	18	124	269
150	281	22	129	169	1185	2583	7	9	63	137
151	360	22	75	98	688	1499	5	7	47	102
152	88	32	2	3	22	48	0	0	0	1
153	66	31	53	70	490	1068	1	1	6	13
154	173	32	56	73	512	1116	2	2	17	37
155	258	31	255	334	2341	5102	12	16	115	250
156	645	29	141	185	1295	2822	17	23	158	345
157	218	27	115	150	1053	2296	5	6	43	95
158	185	23	208	272	1909	4161	7	10	67	146
159	354	22	324	424	2970	6473	22	28	199	434
160	470	28	60	78	549	1196	5	7	49	106
161	94	21	201	263	1843	4018	4	5	33	72
162	50	21	21	27	190	415	0	0	2	4
163	66	21	180	236	1653	3603	2	3	21	45
164	367	33	49	65	454	988	3	5	32	69
165	124	30	115	150	1053	2296	3	4	25	54
166	84	30	107	140	980	2136	2	2	16	34
167	956	30	107	140	980	2136	19	25	177	387
168	380	15	54	71	497	1084	4	5	36	78
169	293	21	161	211	1478	3220	9	12	82	179
170	205	33	9	11	80	175	0	0	3	7
174	502	14	144	189	1324	2886	14	18	126	274
175	640	22	397	519	3636	7924	48	63	441	961
176	319	26	853	1116	7820	17043	51	67	472	1028
177	286	29	853	1116	7820	17043	46	60	424	923
178	353	23	708	926	6488	14141	47	62	434	947
179	348	31	891	1165	8164	17792	59	77	538	1172
180	366	20	555	726	5084	11080	38	50	352	768
181	453	19	117	153	1075	2344	10	13	92	201
182	119	19	117	153	1075	2344	3	3	24	53
183	50	19	100	131	914	1993	1	1	9	19
184	54	19	11	15	102	223	0	0	1	2
185	62	19	167	218	1529	3332	2	3	18	39
186	39	19	217	284	1990	4336	2	2	15	32
188	212	33	10	13	88	191	0	1	4	8
190	193	33	8	10	73	159	0	0	3	6
192	540	5	50	66	461	1004	5	7	47	103
193	138	22	399	522	3658	7972	10	14	95	208
194	932	22	405	529	3709	8083	71	93	654	1426
195	79	20	89	117	819	1786	1	2	12	27
196	49	20	176	230	1609	3507	2	2	15	32
197	83	12	176	230	1609	3507	3	4	25	55
198	692	12	196	256	1792	3906	26	34	235	512

Table G-7 2011 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
199	70	27	98	128	900	1961	1	2	12	26
201	160	8	17	22	154	335	1	1	5	10
202	335	22	17	22	154	335	1	1	10	21
204	2022	6	210	275	1924	4193	80	105	737	1606
205	71	27	298	389	2728	5947	4	5	37	80
206	142	27	208	272	1909	4161	6	7	51	112
207	859	32	286	375	2626	5724	47	61	427	931
208	284	32	223	292	2048	4464	12	16	110	240
209	80	20	419	548	3840	8370	6	8	58	127
210	71	20	381	499	3497	7621	5	7	47	103
211	390	20	640	837	5867	12786	47	62	433	944
212	117	20	330	432	3028	6600	7	10	67	147
213	1344	23	825	1079	7564	16485	210	275	1926	4198
214	449	31	1175	1538	10775	23484	100	131	916	1996
215	1110	31	151	197	1383	3013	32	41	291	633
216	905	31	452	591	4140	9024	78	101	710	1548
217	1050	31	315	412	2889	6297	63	82	574	1252
218	581	27	523	685	4799	10459	58	75	528	1150
219	1063	31	372	487	3409	7429	75	98	687	1496
220	415	31	411	538	3767	8211	32	42	296	645
221	698	26	42	55	388	845	6	7	51	112
222	1920	26	4	5	37	80	1	2	13	29
223	1564	29	899	1176	8237	17952	266	348	2440	5317
224	377	28	437	572	4009	8737	31	41	287	624
225	551	28	115	150	1053	2296	12	16	110	240
226	788	32	221	289	2026	4416	33	43	302	659
227	1303	32	226	295	2070	4512	56	73	511	1113
228	580	30	967	1265	8866	19323	106	139	974	2124
229	1653	29	402	526	3687	8035	126	165	1154	2515
230	2058	28	565	739	5179	11288	220	288	2019	4400
231	1300	11	564	738	5172	11272	139	182	1273	2775
232	736	12	1187	1552	10877	23707	165	216	1516	3303
233	488	27	733	958	6715	14636	68	89	621	1353
234	449	16	333	435	3050	6648	28	37	259	565
235	310	10	231	303	2121	4623	14	18	125	271
236	310	7	101	133	929	2025	6	8	55	119
237	105	6	152	198	1390	3029	3	4	28	60
238	697	23	37	48	336	733	5	6	44	97
239	186	22	19	25	176	383	1	1	6	13
240	145	23	143	187	1309	2854	4	5	36	79
241	578	23	162	212	1485	3236	18	23	163	355
242	125	31	37	48	336	733	1	1	8	17
243	564	31	37	48	336	733	4	5	36	78
244	88	31	37	48	336	733	1	1	6	12
246	175	14	162	212	1485	3236	5	7	49	107
247	65	15	3	4	29	64	0	0	0	1
248	39	14	202	264	1851	4034	1	2	14	30
249	128	14	165	216	1514	3300	4	5	37	80
250	484	14	175	229	1602	3492	16	21	147	320
252	308	15	214	280	1960	4273	13	16	115	250
253	54	14	12	16	110	239	0	0	1	2
255	290	23	3	4	29	64	0	0	2	4
256	377	23	4	5	37	80	0	0	3	6

Table G-7 2011 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME AM Peak	VOLUME PM Peak	VOLUME High 8-Hour	VOLUME AWDT	VMT AM Peak	VMT PM Peak	VMT High 8-Hour	VMT AWDT
257	215	23	3	4	29	64	0	0	1	3
260	362	23	3	4	29	64	0	0	2	4
261	219	25	4	5	37	80	0	0	2	3
262	218	13	6	8	59	128	0	0	2	5
265	2458	27	95	124	870	1897	44	58	405	883
266	752	27	479	626	4389	9566	68	89	625	1362
267	1323	27	531	694	4864	10602	133	174	1218	2656
268	450	14	676	884	6196	13504	58	75	529	1152
269	801	6	657	859	6020	13121	100	130	913	1991
270	1005	8	472	618	4330	9438	90	118	824	1796
271	1048	14	233	305	2136	4655	46	61	424	924
272	665	23	117	153	1075	2344	15	19	135	295
273	294	10	110	144	1009	2200	6	8	56	122
274	1244	28	431	564	3950	8609	102	133	931	2028
275	50	28	421	551	3862	8418	4	5	36	79
276	599	28	124	162	1134	2471	14	18	129	280
277	2473	17	98	128	900	1961	46	60	422	919
278	573	31	264	346	2421	5277	29	38	263	573
279	458	21	272	356	2494	5437	24	31	216	471
280	295	26	164	214	1500	3268	9	12	84	183
281	440	18	164	215	1507	3284	14	18	125	273
282	76	18	145	190	1331	2902	2	3	19	42
283	697	18	320	419	2933	6393	42	55	387	843
284	690	17	654	856	5998	13073	85	112	783	1707
285	91	17	587	768	5384	11734	10	13	93	202
286	464	17	816	1068	7483	16310	72	94	658	1434
287	229	18	786	1028	7205	15704	34	45	313	682
288	500	13	762	997	6986	15226	72	94	661	1440
289	738	11	1341	1755	12297	26800	187	245	1719	3746
290	190	14	1101	1441	10095	22001	40	52	363	791
291	494	27	311	407	2853	6218	29	38	267	582
292	689	26	789	1033	7235	15768	103	135	944	2056
293	325	26	1486	1944	13621	29686	91	120	839	1828
294	396	23	240	314	2202	4799	18	24	165	360
295	1017	29	1248	1633	11441	24935	240	315	2204	4804
296	162	8	229	300	2099	4576	7	9	64	141
297	140	8	158	207	1448	3157	4	5	38	84
298	951	12	180	235	1646	3587	32	42	297	646
299	805	18	152	198	1390	3029	23	30	212	462
300	518	5	115	150	1053	2296	11	15	103	225
301	749	5	160	210	1470	3205	23	30	209	455
302	652	14	241	315	2209	4815	30	39	273	595
303	547	5	61	79	556	1212	6	8	58	125
304	406	5	53	70	490	1068	4	5	38	82
305	442	5	28	37	256	558	2	3	21	47
306	207	16	81	106	746	1626	3	4	29	64
307	70	5	136	177	1244	2710	2	2	16	36
308	319	10	63	82	578	1259	4	5	35	76
309	281	5	128	168	1178	2567	7	9	63	137
310	555	30	428	560	3921	8545	45	59	412	897
311	208	26	2109	2759	19334	42137	83	109	762	1660
312	125	26	796	1042	7300	15911	19	25	173	377

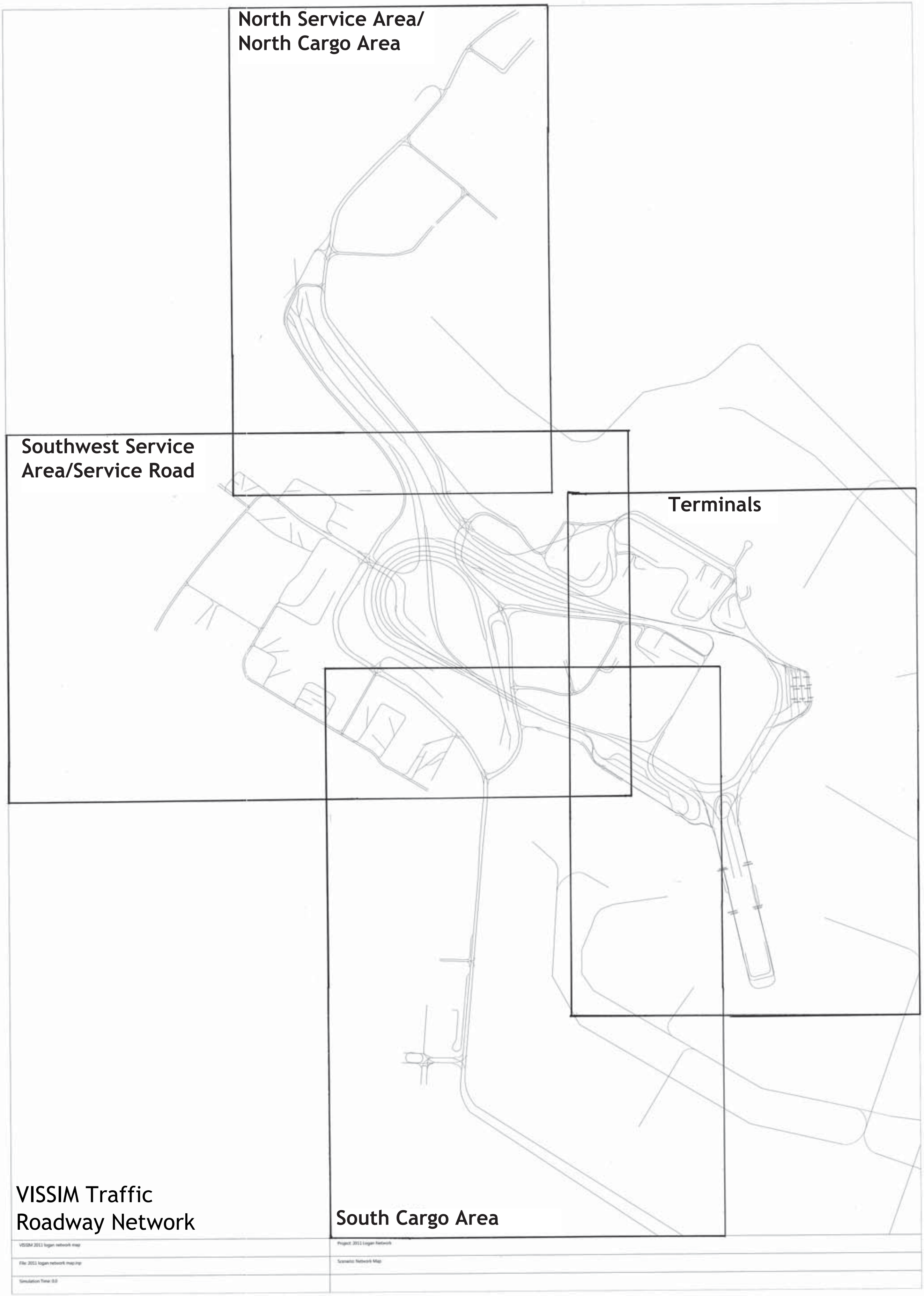
Table G-7 2011 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

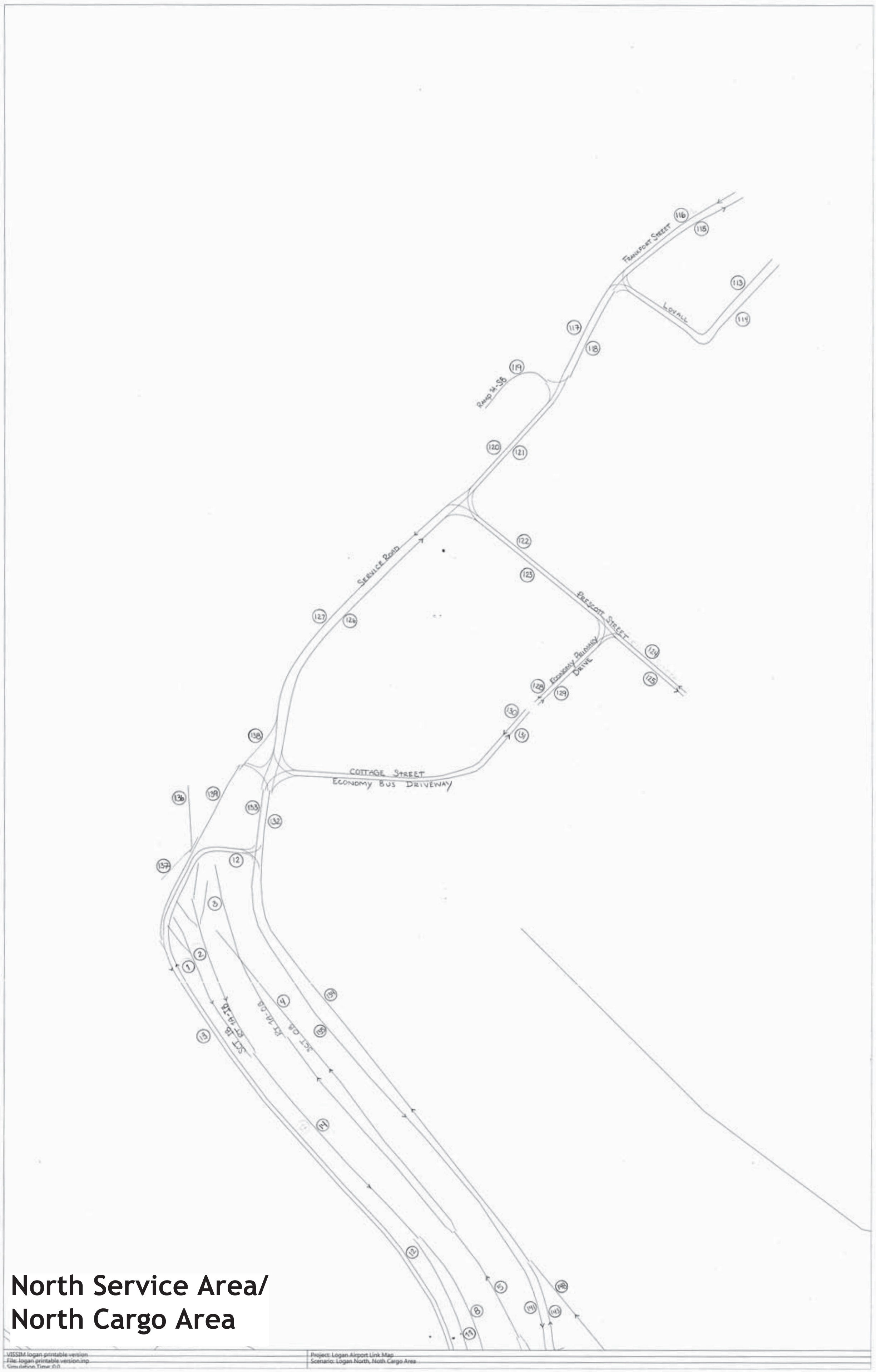
			VOLUME				VMT			
Link Name	Link Distance (ft)	Link Speed (mph)	AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
313	332	26	792	1036	7256	15815	50	65	457	995
314	440	26	1290	1688	11828	25780	108	141	986	2149
315	215	14	543	711	4982	10857	22	29	203	442
316	543	13	151	197	1383	3013	16	20	142	310
317	180	8	236	309	2165	4719	8	11	74	161
318	221	5	236	309	2165	4719	10	13	91	197
319	2544	5	375	491	3438	7493	181	237	1656	3610
320	552	9	444	582	4074	8880	46	61	426	928
321	628	13	88	115	805	1754	10	14	96	209
322	181	10	128	167	1170	2551	4	6	40	87
323	58	10	109	142	995	2168	1	2	11	24
324	387	12	18	24	168	367	1	2	12	27
325	406	10	127	166	1163	2535	10	13	89	195
326	89	5	60	78	549	1196	1	1	9	20
327	463	16	136	179	1251	2726	12	16	110	239
328	79	20	182	238	1668	3635	3	4	25	54
329	103	20	182	238	1668	3635	4	5	32	71
330	323	12	41	53	373	813	3	3	23	50
331	179	9	361	472	3306	7206	12	16	112	244
332	993	8	535	701	4908	10698	101	132	923	2012
333	384	13	14	19	132	287	1	1	10	21
334	366	14	460	602	4221	9199	32	42	292	637
335	583	31	855	1118	7834	17075	94	123	865	1885
336	428	32	610	798	5589	12180	49	65	453	988
337	94	18	185	242	1697	3699	3	4	30	66
338	366	5	159	208	1456	3173	11	14	101	220
339	311	7	26	33	234	510	2	2	14	30
340	273	18	22	28	198	430	1	1	10	22
341	66	7	22	28	198	430	0	0	2	5
343	52	27	90	118	827	1802	1	1	8	18
344	82	8	10	14	95	207	0	0	1	3
345	25	5	61	79	556	1212	0	0	3	6
346	121	5	61	79	556	1212	1	2	13	28
347	303	19	71	93	651	1419	4	5	37	81
348	146	21	437	571	4001	8721	12	16	111	241
349	67	21	315	412	2889	6297	4	5	37	80
350	446	5	122	160	1119	2439	10	14	94	206
351	335	5	101	133	929	2025	6	8	59	129
352	430	5	120	157	1097	2391	10	13	89	195
353	360	5	194	254	1778	3874	13	17	121	264
354	50	19	173	227	1587	3460	2	2	15	33
355	88	9	321	420	2941	6409	5	7	49	107
356	113	9	429	561	3928	8561	9	12	84	183
357	965	23	298	389	2728	5947	54	71	499	1087
358	463	13	341	446	3124	6808	30	39	274	597
359	229	25	10	13	88	191	0	1	4	8
360	245	21	13	17	117	255	1	1	5	12
361	248	19	22	28	198	430	1	1	9	20
362	199	18	32	42	293	638	1	2	11	24
363	230	11	30	39	271	590	1	2	12	26
364	256	13	386	505	3540	7716	19	25	172	374

Table G-7 2011 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

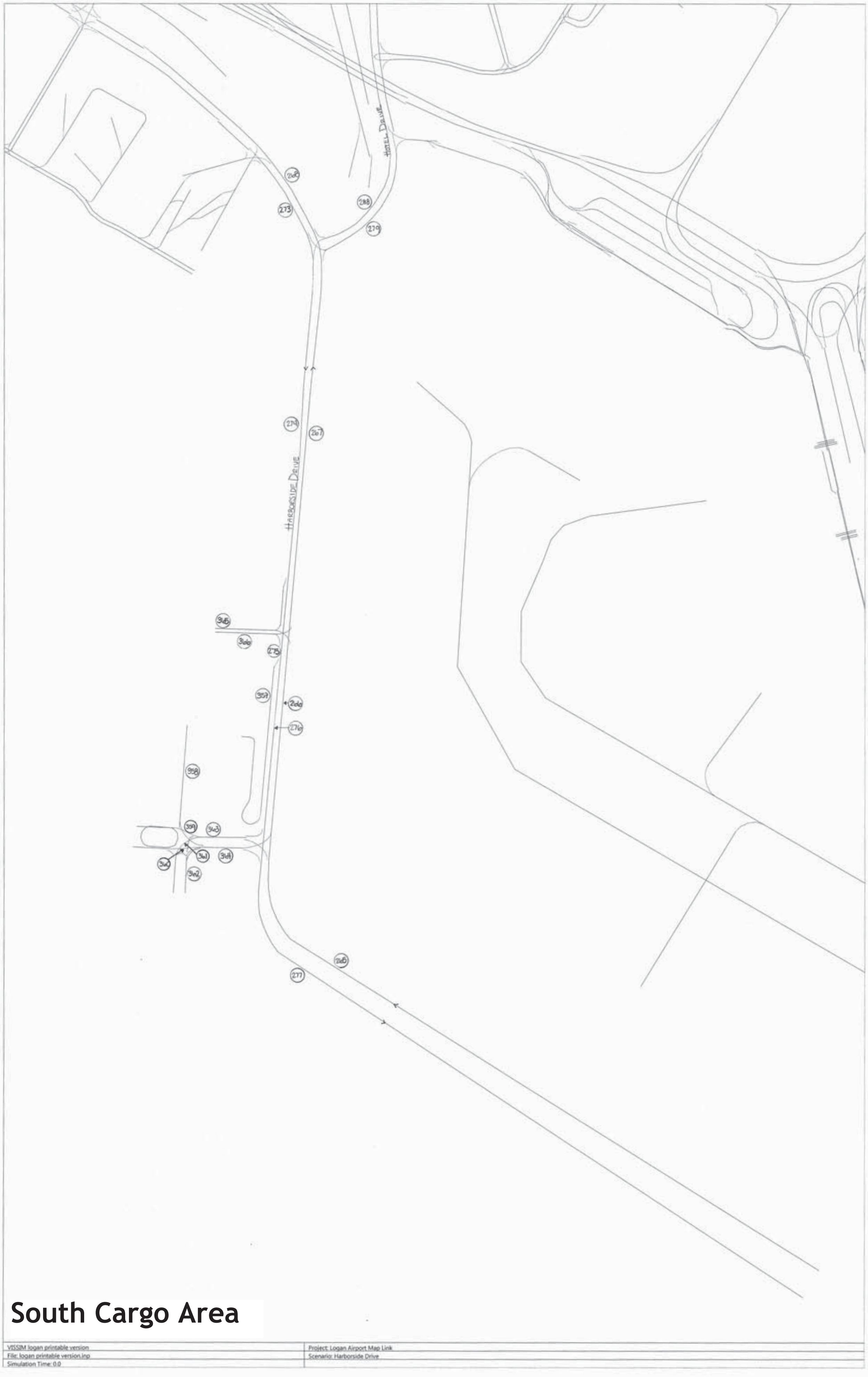
Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME AM Peak	VOLUME PM Peak	VOLUME High 8-Hour	VOLUME AWDT	VMT AM Peak	VMT PM Peak	VMT High 8-Hour	VMT AWDT
365	201	25	14	18	124	271	1	1	5	10
366	201	10	72	94	658	1435	3	4	25	55
367	337	31	764	1000	7008	15273	49	64	447	975
368	868	10	528	691	4843	10554	87	114	797	1736
369	167	10	493	645	4521	9853	16	20	143	312
370	96	12	244	319	2238	4879	4	6	41	88
371	141	24	393	514	3599	7844	10	14	96	209
				Logan Airport VMT			8390.96	10977.97	76920.2	167646.51

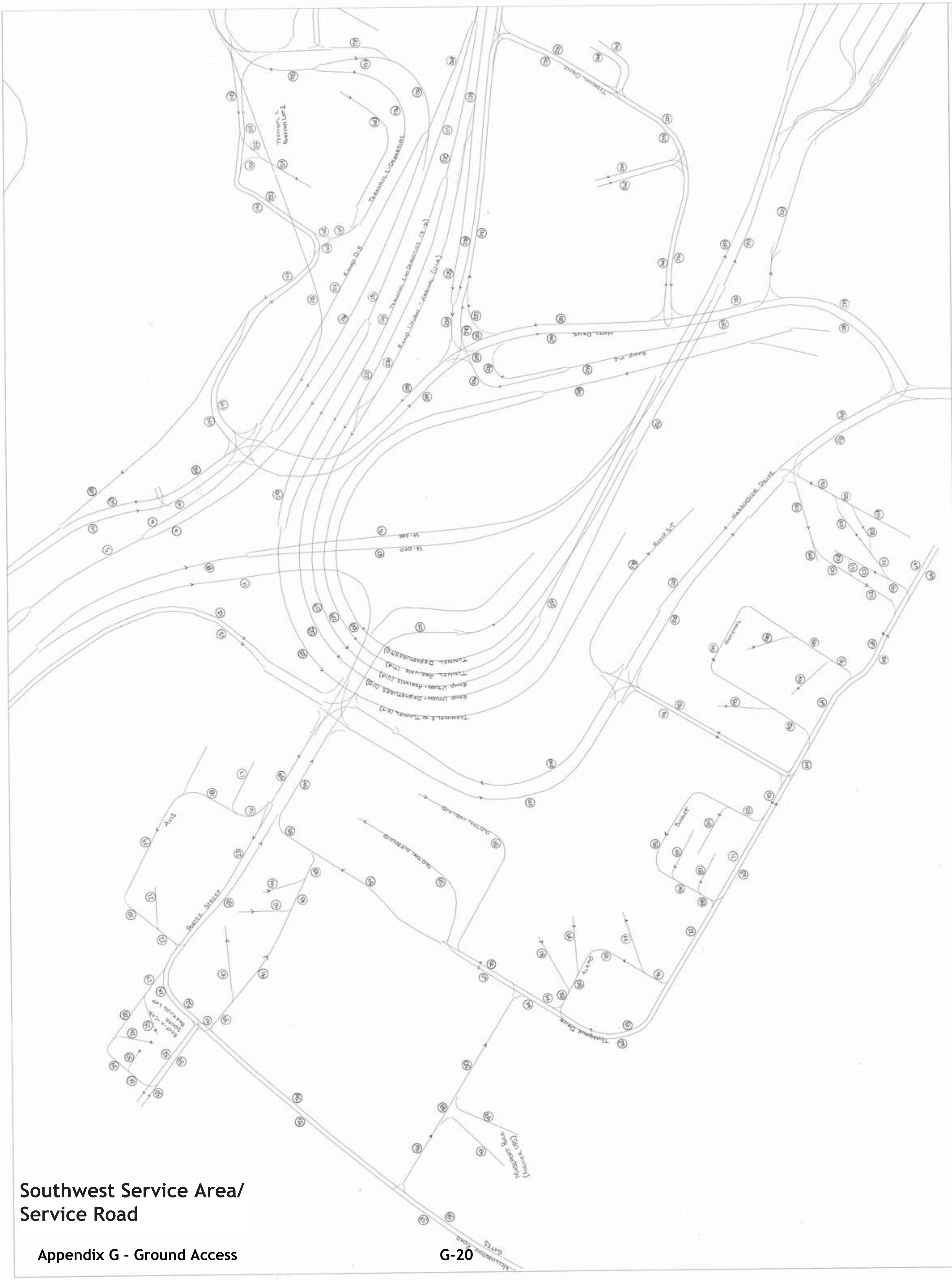
Source: VHB.
Note: AWDT Average annual weekday daily traffic


North Service Area/
North Cargo Area
Southwest Service
Area/Service Road
Terminals
South Cargo Area
VISSIM Traffic
Roadway Network
VISSIM 2011 logan network map
File: 2011 logan network map.inp
Simulation Time: 0.0
Project: 2011 Logan Network
Scenario: Network Map

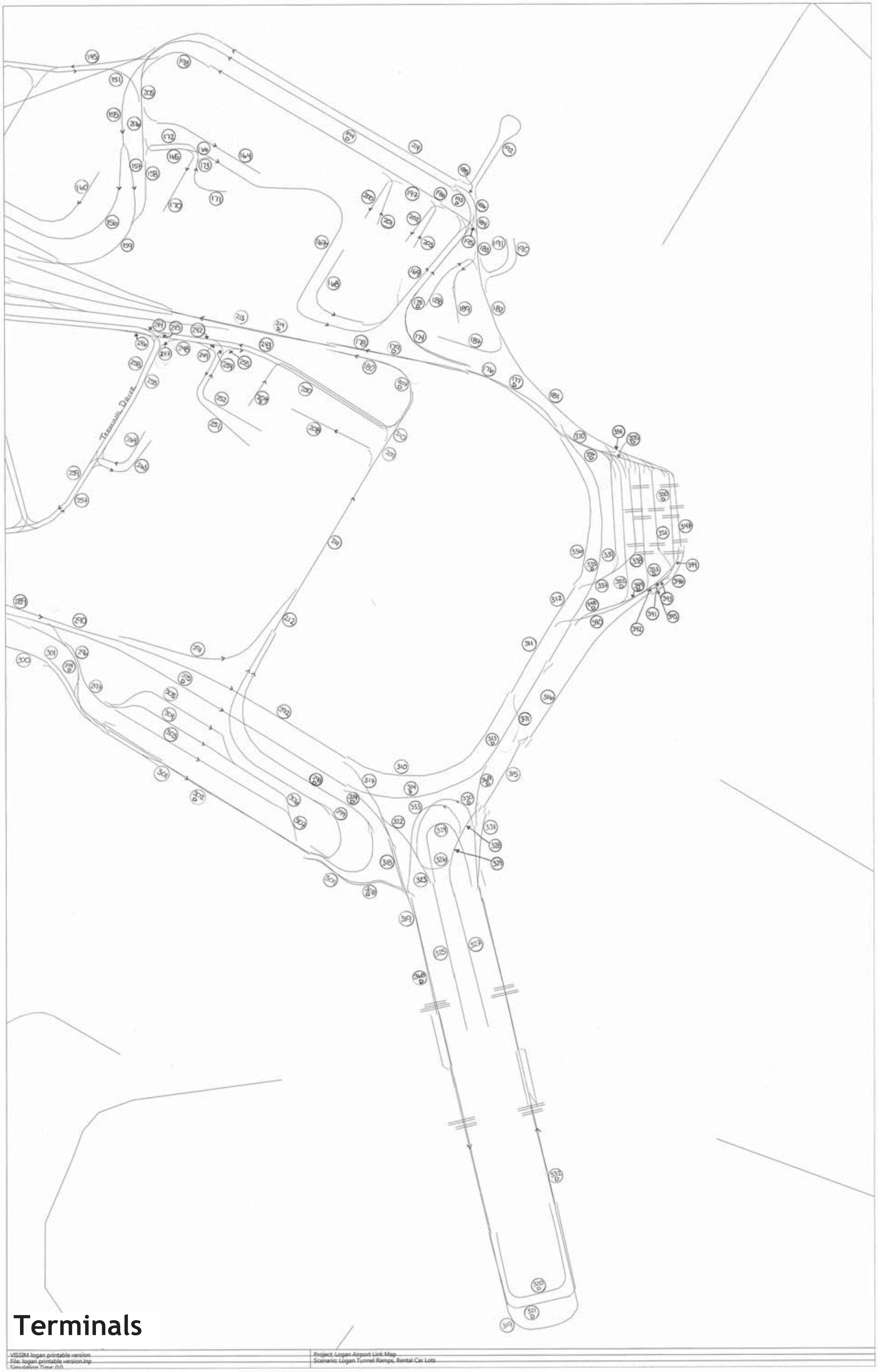


North Service Area/
North Cargo Area


Hotel Drive
Harborside Drive
South Cargo Area
VISSIM logan printable version
File: logan printable version.inp
Simulation Time: 0.0
Project: Logan Airport Map Link
Scenario: Harborside Drive



Southwest Service Area/ Service Road


Terminal Drive
Terminals
VISSIM logan printable version
File: logan printable version.inp
Simulation Time: 0.0
Project: Logan Airport Link Map
Scenario: Logan Tunnel Ramps, Rental Car Lots

Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128-2909
Telephone (617) 568-5000
www.massport.com

March 1st, 2011

Christine Kirby
Department of Environmental Protection
Division of Air Quality Control
One Winter Street
Boston, MA 02108

Re: March 1st, 2011 Logan Airport Parking Space Inventory

Dear Ms. Kwetz:

In compliance with the reporting requirements of 310 CMR 7.30 (3)(d), enclosed are the following March 1st, 2011 Massachusetts Port Authority submissions:

- Commercial Parking Space Inventory
- Employee Parking Space Inventory
- Location Map

Massport's parking program remains in compliance with the Aviation and Transportation Security Act of 2001 (ATSA) and supplemental FAA security directives, and our top priority continues to be the safe and secure operation of our transportation and parking facilities.. We continue to provide information on rental car spaces as a courtesy.

The attachments provide the quantity, physical distribution and allocation of commercial and employee parking spaces as defined by 310 CMR 7.30, as amended. These inventory tables are based on information provided by the Aviation Department's Ground Transportation Unit, as supplemented by field checks, and represent the most up to date information on parking at Logan International Airport as of March 1st, 2011.

The Commercial Parking Space Inventory now totals 17,619 parking spaces (17,596 in service and 23 designated). The Employee Parking Space Inventory totals 3,073 employee parking spaces (2,592 in service and 481 designated). Designated spaces reflect parking spaces that are temporarily out of service. The total inventory of spaces at Logan Airport remains unchanged at 20,692.

The Authority has consolidated economy parking spaces in the North Cargo Area by completing construction of two decks over the existing economy parking lot on Prescott Street. The enabling projects necessary to advance the construction of the new rental car facility are ongoing. This has resulted in relocation of employee spaces and will require relocation of commercial spaces; in some cases, spaces may be temporarily removed from or added to service. And effective February 21st, 2011, the Authority converted 300 spaces from the employee to the commercial category.

The attached Logan Airport Parking Space Inventory reflects Massport's successful management of its parking program, within the requirements of 310 CMR 7.30, as amended. If you have any questions, please call me at (617) 568-3570.

Sincerely,

Craig Leiner

Craig Leiner
Economic Planning & Development Department

cc: L. Dantas
S. Dalzell
I. Wallach
B. Desrosiers
D. Cook

Commercial Parking Spaces

Map ID#	Location of Commercial Parking Areas	Number of Spaces
Terminal Area and Economy Spaces		
C1a	Central Garage	7,227
C1b	West Garage	3,148
C2	Terminal B Garage	2,380
C3	Lot 3 (former USPS site) (Red Lot)	416
C6	Economy Garage	2,880
C8a	Terminal E Lot 1	269
C8b	Terminal E Lot 2	257
C9	"Gulf Station" Lot	229
	~~"Sky Chefs"/Purple Lot~~ *(closed)*	0
	~~Orange Lot (Wood Is. lot)~~ *(closed)*	0
C12	SWSA Lot *(temporary; to close in April)*	250
	subtotal	*17,056*
Hotel Spaces		
C4	Logan Airport Hilton Hotel (two lots)	235
C7a	Harborside Hyatt Conference Center	270
	subtotal	*505*
General Aviation Spaces		
C5	Signature (General Aviation Terminal)	35
	subtotal	*35*

Total In-Service Commercial Parking Spaces	**17,596**
Total Designated Commercial Parking Spaces	**23**
Total Commercial Parking Spaces	**17,619**
Total Employee Parking Spaces *(see table on next page)*	**3,073**
TOTAL PARKING FREEZE SPACES	**20,692**

Employee Parking Spaces

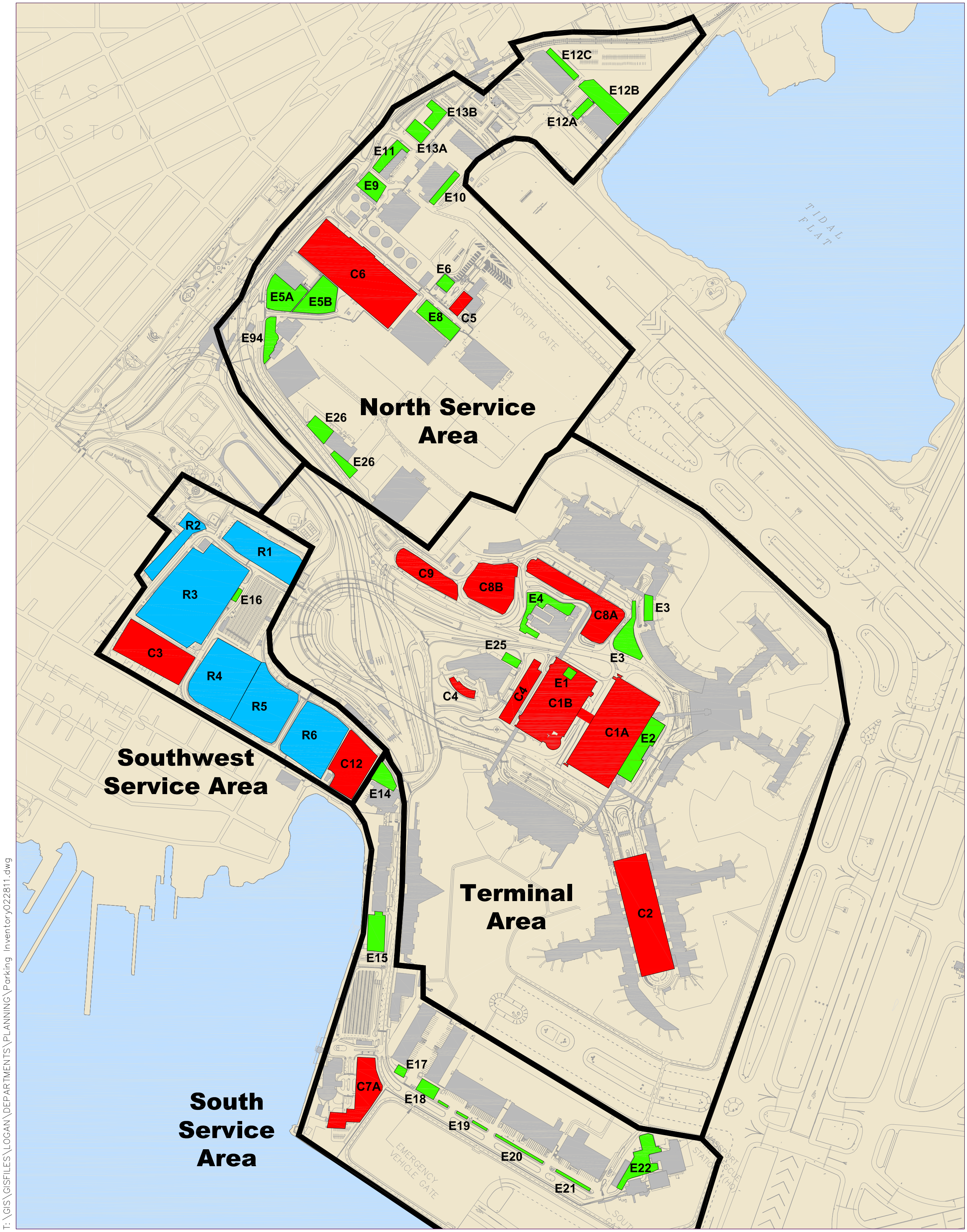
Map ID#	Location of Employee Parking Areas	Number of Spaces
E1	Central Parking / West Garage	93
E2	Massport Tower	517
E3	Terminal C Pier A (Old Terminal D) (two lots)	45
E4	Massport Facilities 1 (Heating Plant)	94
E5a	North Cargo Building 11, TSA lot	81
E5b	North Cargo Building 11, State Police lot	158
E6	North Gate & EMS Trailer	31
E8	North Cargo Building 8	70
E9	US Airways Administration	90
E10	Massport Facilities 2 (airside)	35
E11	Massport Facilities 3	95
E12a	LSG Sky Chefs, main lot	34
	LSG Sky Chefs, overflow 1 *(closed)*	0
	LSG Sky Chefs, overflow 2 *(closed)*	0
E12b	LSG Sky Chefs, overflow lot	102
E12c	Flight Kitchen Building 1	40
E13a	"Consigli Lot" (Lovell Street)	30
E13b	Lovell Lot	38
E14	Gate Gourmet	85
E15	Bird Island Flats (BIF) / LOC Garage	504
E16	Massport Taxi Pool	10
	Lot B *(closed for construction)*	0
E17	South Cargo Building 63	16
E18	South Cargo Building 62	51
E19	South Cargo Building 58	23
E20	South Cargo Building 57	44
E21	South Cargo Building 56	72
E22	Fire-Rescue HQ & Amelia Earhart Building	89
E25	Hilton Hotel	30
E26	UPS (Cargo Building 13)	44
E94	United Aircraft Maint. (Buildings 93 & 94)	66
N/A	*ARFF Satellite Station* [1]	5

[1] This facility is located on the airfield and is not shown in the map.

Total In-Service Employee Parking Spaces	**2,592**
Total Designated Employee Parking Spaces	**481**
Total Employee Parking Spaces	**3,073**
Total Commercial Parking Spaces *(see table on previous page)*	**17,619**
TOTAL PARKING FREEZE SPACES	**20,692**

Rental Car Company Parking Spaces

Map ID#	Number of Spaces
R1	1,027
R2	130
R3	1,016
R4	1,550
R5	960
R6	337
Total Rental Car Spaces	**5,020**



Logan Airport Parking Space Inventory

Logan International Airport
East Boston, MA

Massachusetts Port Authority
March 1, 2011

Legend:

- Logan Parking Service Area Zones
- Commercial Parking Space Locations
- Employee Parking Space Locations
- Rental Car Parking Space Locations

Notes:

This plan is intended for informational purposes only and no use may be made of the same without the express written permission of the Massachusetts Port Authority ("Massport"). Massport does not certify the accuracy, information or title to the properties contained in this plan nor make any warranties of any kind, express or implied, in fact or by law, with respect to any boundaries, easements, restrictions, claims, overlaps or other encumbrances affecting such properties.

Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128-2909
Telephone (617) 568-5000
www.massport.com

September 1st, 2011

Christine Kirby
Department of Environmental Protection
Division of Air Quality Control
One Winter Street
Boston, MA 02108

Re: September 1st, 2011 Logan Airport Parking Space Inventory

Dear Ms. Kirby:

In compliance with the reporting requirements of 310 CMR 7.30 (3)(d), enclosed are the following September 1st, 2011 Massachusetts Port Authority submissions:

- Commercial Parking Space Inventory
- Employee Parking Space Inventory
- Location Map

Massport's parking program remains in compliance with the Aviation and Transportation Security Act of 2001 (ATSA) and supplemental FAA security directives, and our top priority continues to be the safe and secure operation of our transportation and parking facilities. We continue to provide information on rental car spaces as a courtesy.

The attachments provide the quantity, physical distribution and allocation of commercial and employee parking spaces as defined by 310 CMR 7.30, as amended. These inventory tables are based on information provided by the Aviation Department's Ground Transportation Unit, as supplemented by field checks, and represent the most up to date information on parking at Logan International Airport as of September 1st, 2011.

The Commercial Parking Space Inventory now totals 18,019 parking spaces (16,072 in service and 1,947 designated). The Employee Parking Space Inventory totals 2,673 employee parking spaces (2,603 in service and 70 designated). Designated spaces reflect parking spaces that are temporarily out of service. The total inventory of spaces at Logan Airport remains unchanged at 20,692.

Terminal B Garage capacity has been reduced by approximately 650 spaces due to garage and roadway construction.

The South West Service Area is now under construction as part of the Consolidated Rental Car project and this will affect the location and number of rental car spaces until the project is completed in 2015. Therefore, the Rental Car Parking Space locations on the attached map may not reflect current site conditions.

The attached Logan Airport Parking Space Inventory reflects Massport's successful management of its parking program, within the requirements of 310 CMR 7.30, as amended. If you have any questions, please call me at (617) 568-3570.

Sincerely,

Craig Leiner
Economic Planning & Development Department

cc: L. Dantas
S. Dalzell
I. Wallach
B. Desrosiers
D. Cook

Commercial Parking Space Inventory
Logan International Airport
September 1, 2011 Submission

Commercial Parking Spaces

Map ID#	Location of Commercial Parking Areas	Number of Spaces
Terminal Area and Economy Spaces		
C1a	Central Garage	7,196
C1b	West Garage	3,148
C2	Terminal B Garage	1,644
~~C3~~	~~Lot 3 (former USPS site) (Red Lot)~~ *(closed)*	0
C6	Economy Garage	2,789
C8a	Terminal E Lot 1	269
C8b	Terminal E Lot 2	257
C9	"Gulf Station" Overflow Lot	229
~~C12~~	~~SWSA Lot~~ *(closed)*	0
	subtotal	*15,532*
Hotel Spaces		
C4	Logan Airport Hilton Hotel (two lots)	235
C7a	Harborside Hyatt Conference Center	270
	subtotal	*505*
General Aviation Spaces		
C5	Signature (General Aviation Terminal)	35
	subtotal	*35*

Total In-Service Commercial Parking Spaces	**16,072**
Total Designated Commercial Parking Spaces	**1,947**
Total Commercial Parking Spaces	**18,019**
Total Employee Parking Spaces *(see table on next page)*	**2,673**
TOTAL PARKING FREEZE SPACES	**20,692**

Employee Parking Space Inventory
Logan International Airport
September 1, 2011 Submission

Employee Parking Spaces

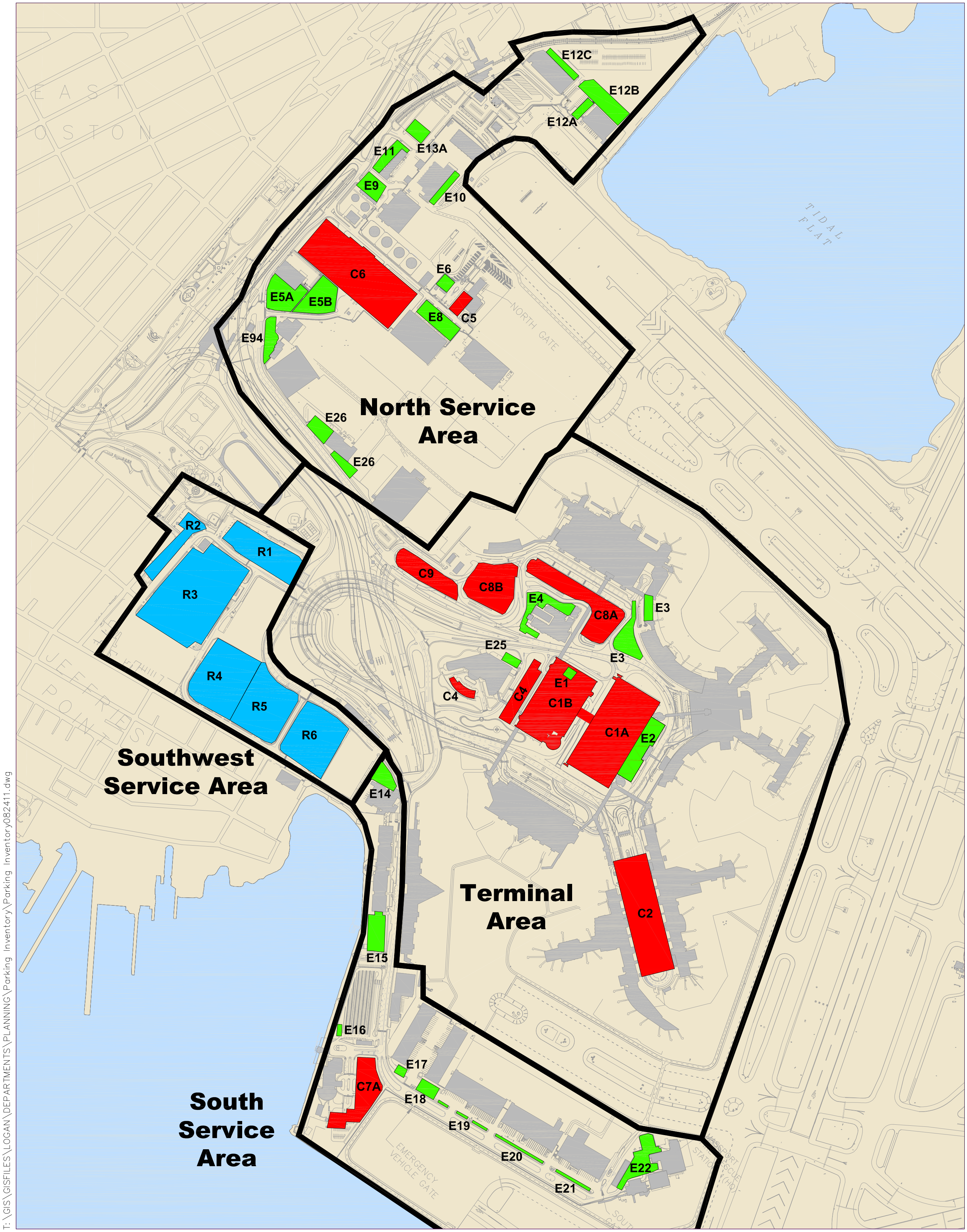
Map ID#	Location of Employee Parking Areas	Number of Spaces
E1	Central Parking / West Garage	93
E2	Massport Tower	517
E3	Terminal C Pier A (Old Terminal D) (two lots)	87
E4	Massport Facilities 1 (Heating Plant)	94
E5a	North Cargo Building 11, TSA lot	81
E5b	North Cargo Building 11, State Police lot	158
E6	North Gate & EMS Trailer	31
E8	North Cargo Building 8	111
E9	US Airways Administration	84
E10	Massport Facilities 2 (airside)	35
E11	Massport Facilities 3	95
E12a	LSG Sky Chefs, main lot	34
E12b	LSG Sky Chefs, overflow lot	111
E12c	Flight Kitchen Building 1	22
E13a	Lovell Street Lot	12
E13b	Lovell-Neptune Street Lot	0
E14	Gate Gourmet	85
E15	Bird Island Flats (BIF) / LOC Garage	504
E16	Massport Taxi Pool	9
E17	South Cargo Building 63	16
E18	South Cargo Building 62	51
E19	South Cargo Building 58	23
E20	South Cargo Building 57	44
E21	South Cargo Building 56	72
E22	Fire-Rescue HQ & Amelia Earhart Building	89
E25	Hilton Hotel	30
E26	UPS (Cargo Building 13)	44
E94	United Aircraft Maint. (Buildings 93 & 94)	66
N/A	*ARFF Satellite Station* [1]	5

[1] This facility is located on the airfield and is not shown in the map.

Total In-Service Employee Parking Spaces	**2,603**
Total Designated Employee Parking Spaces	**70**
Total Employee Parking Spaces	**2,673**
Total Commercial Parking Spaces *(see table on previous page)*	**18,019**
TOTAL PARKING FREEZE SPACES	**20,692**

Rental Car Company Parking Spaces

Map ID#	Number of Spaces
R1	1,027
R2	130
R3	1,016
R4	1,550
R5	960
R6	337
Total Rental Car Spaces	**5,020**



Logan Airport
Parking Space Inventory

Logan International Airport
East Boston, MA

massport
Massachusetts Port Authority
September 1, 2011

Legend:

- Logan Parking Service Area Zones
- Commercial Parking Space Locations
- Employee Parking Space Locations
- Rental Car Parking Space Locations

Notes:

This plan is intended for informational purposes only and no use may be made of the same without the express written permission of the Massachusetts Port Authority ("Massport"). Massport does not certify the accuracy, information or title to the properties contained in this plan nor make any warranties of any kind, express or implied, in fact or by law, with respect to any boundaries, easements, restrictions, claims, overlaps or other encumbrances affecting such properties.

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Noise Abatement

This appendix provides detailed information, tables, and figures in support of *Chapter 6, Noise Abatement*:

Fundamentals of Acoustics and Environmental Noise

Introduction

This section provides an introduction to the fundamentals of acoustics and to noise terminology, the effects of noise on human activity, and the effects on community annoyance.

Introduction to Acoustics and Noise Terminology

Chapter 6, Noise Abatement of this *2011 Environmental Status and Planning Report (2011 ESPR)* relies largely on a measure of cumulative noise exposure over an entire calendar year, in terms of a metric called the Day-Night Average Sound Level (DNL). However, DNL does not always provide a sufficient description of noise for many purposes. A variety of other measures are available to address essentially any issue of concern. This section introduces the following acoustic metrics, which are all related to DNL, but provide bases for evaluating a broad range of noise situations.

- Decibel (dB)
- A-Weighted Decibel (dBA)
- Sound Exposure Level (SEL)
- Equivalent Sound Level (L_{eq})
- Time Above (TA)
- Time Above, Night (TAN)
- DNL.

The Decibel (dB)
All sounds come from a sound source – a musical instrument, a voice speaking, or an airplane that passes overhead. It takes energy to produce sound. The sound energy produced by any sound source is transmitted through the air in the form of sound waves – tiny, quick oscillations of pressure just above and just below atmospheric pressure. These oscillations, or sound pressures, impinge on the ear, creating the sound we hear.

The human ear is sensitive to a wide range of sound pressures. The loudest sounds that we hear without pain have about one million times more energy than the quietest sounds we hear. But our ears are incapable of detecting small differences in these pressures. Thus, to better match how we hear this sound energy, we compress the total range of sound pressures to a more meaningful range by introducing the concept of sound pressure level (SPL). SPL is a measure of the sound pressure of a given noise source relative to a standard reference value (typically the quietest sound that a young person with good hearing can detect). SPLs are measured in decibels (abbreviated dB). Decibels are logarithmic quantities – logarithms of the squared ratio of two pressures, the numerator being the pressure of the sound source of interest, and the denominator being the reference pressure (the quietest sound we can hear).

The logarithmic conversion of sound pressure to SPL means that the quietest sound we can hear (the reference pressure) has a SPL of about 0dB, while the loudest sounds humans are able to hear without pain have SPLs of about 120 dB. Most sounds in our day-to-day environment have SPLs from 30 to 100 dB.

Because decibels are logarithmic quantities, they do not behave like regular numbers with which we are more familiar. For example, if two sound sources each produce 100 dB and they are operated together, they produce only 103 dB – not 200 dB as we might expect. Four equal sources operating simultaneously result in a total SPL of 106 dB. In fact, for every doubling of the number of equal sources, the SPL goes up another three decibels. A

tenfold increase in the number of sources makes the SPL go up 10 dB. A hundredfold increase makes the level go up 20 dB, and it takes a thousand equal sources to increase the level 30 dB.

If one source is much louder than another, the two sources together will produce the same SPL (and sound to our ears) as if the louder source were operating alone. For example, a 100 dB source plus an 80 dB source produce 100 dB when operating together. The louder source “masks” the quieter one, but if the quieter source gets louder, it will have an increasing effect on the total SPL. When the two sources are equal, as described above, they produce a level three decibels above the sound of either one by itself.

From these basic concepts, note that one hundred 80 dB sources will produce a combined level of 100 dB; if a single 100 dB source is added, the group will produce a total SPL of 103 dB. Clearly, the loudest source has the greatest effect on the total decibel level.

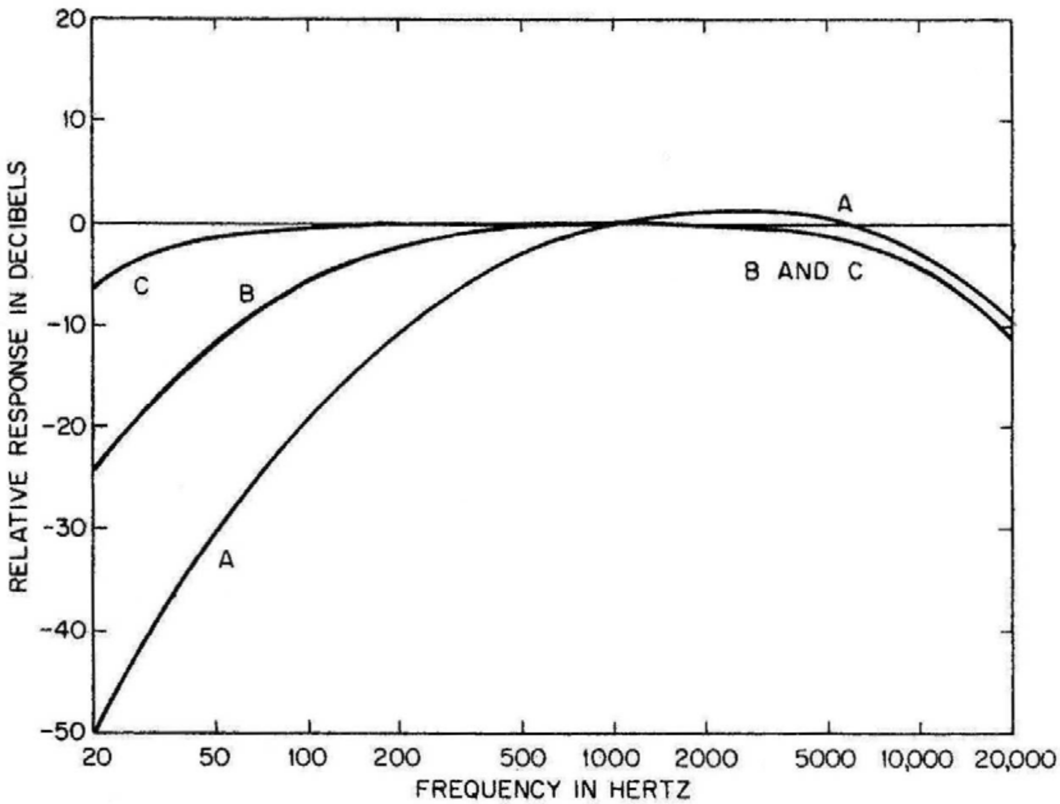
A-Weighted Decibel (dBA)
Another important characteristic of sound is its frequency, or "pitch". This is the rate of repetition of the sound pressure oscillations as they reach our ear. Formerly expressed in cycles per second, frequency is now expressed in units known as Hertz (Hz).

Most people are able to hear from about 20 Hz to about 10,000 to 15,000 Hz. People respond to sound most readily when the predominant frequency is in the range of normal conversation, around 1,000 to 2,000 Hz. Acousticians have developed "filters" to match our ears' sensitivity and help us to judge the relative loudness of sounds made up of different frequencies. The so-called "A" filter does the best job of matching the sensitivity of our ears to most environmental noises. SPLs measured through this filter are referred to as A-weighted levels (dBA). A-weighting significantly de-emphasizes noise at low and high frequencies (below about 500 Hz and above about 10,000 Hz) where we do not hear as well. Because this filter generally matches our ears' sensitivity, sounds having higher A-weighted sound levels are usually judged to be louder than those with lower A-weighted sound levels, a relationship which does not always hold true for unweighted levels. It is for these reasons that A-weighted sound levels are normally used to evaluate environmental noise.

Other weighting networks include the B and C filters. They correspond to different level ranges of the ear. The rarely used B-weighting attenuates low frequencies (those less than 500 Hz), but to a lesser degree than A-weighting. C weighting is nearly flat throughout the audible frequency range, hardly de-emphasizing low frequency noise. C-weighted levels can be preferable in evaluating sounds whose low-frequency components are responsible for secondary effects such as the shaking of a building, window rattle, or perceptible vibrations. Uses include the evaluation of blasting noise, artillery fire, and in some cases, aircraft noise inside buildings.

Figure H-1 compares these various weighting networks.

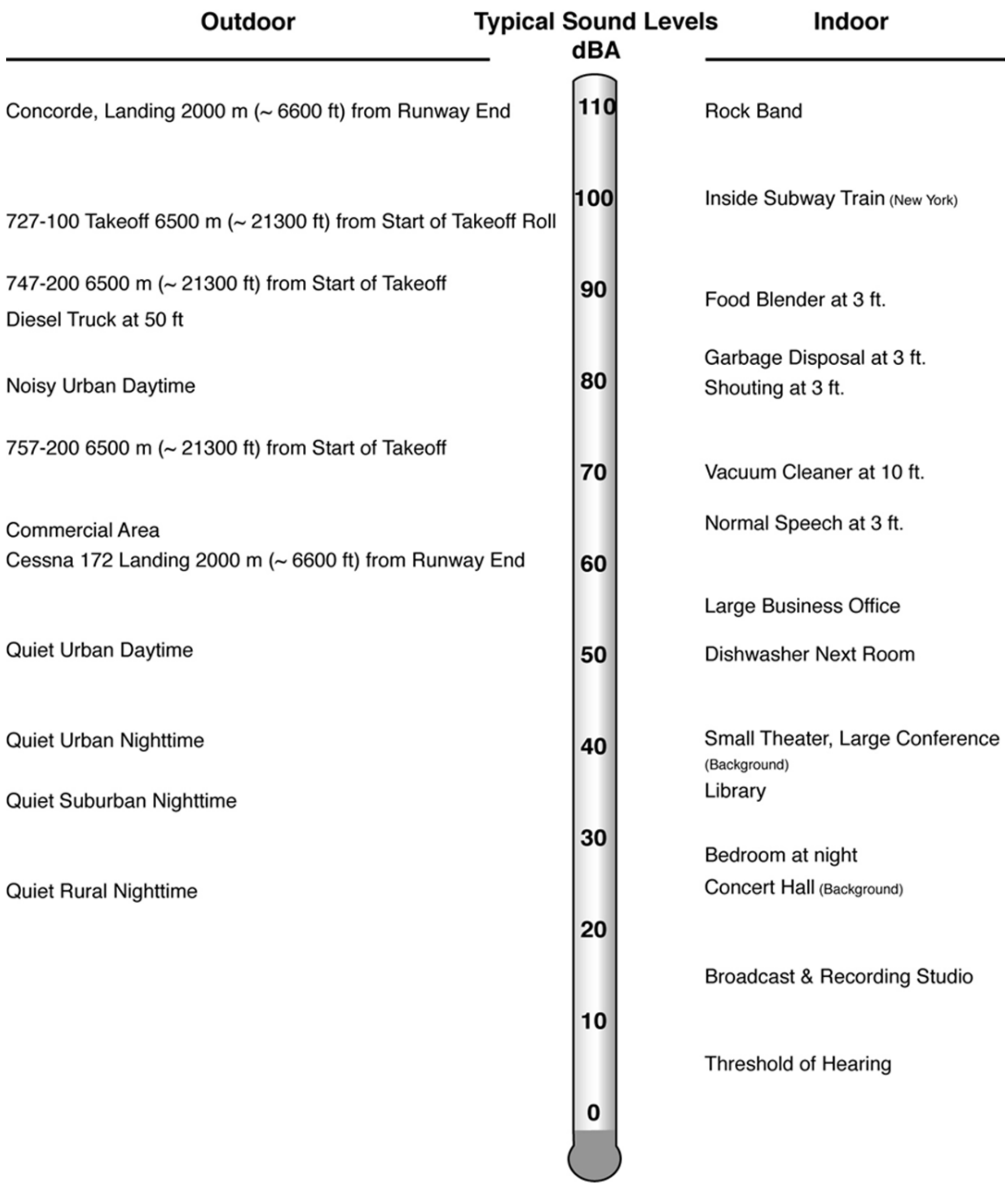
Figure H-1 Frequency-Response Characteristics of Various Weighting Networks



Source: Harris, Cyril M., editor; Handbook of Acoustical Measurements and Noise Control, (Chapter 5, "Acoustical Measurement Instruments"; Johnson, Daniel L.; Marsh, Alan H.; and Harris, Cyril M.); New York; McGraw-Hill, Inc.; 1991; p. 5.13

Because of the correlation with our hearing, the A-weighted level has been adopted as the basic measure of environmental noise by the United States (U.S.) Environmental Protection Agency (EPA) and by nearly every other federal (including the Federal Aviation Administration (FAA)) and state agency concerned with community noise. The FAA noise regulations are codified at Federal Aviation Regulation (FAR), Part 150, Airport Noise Compatibility Planning. Figure H-2 presents typical A-weighted sound levels of several common environmental sources.

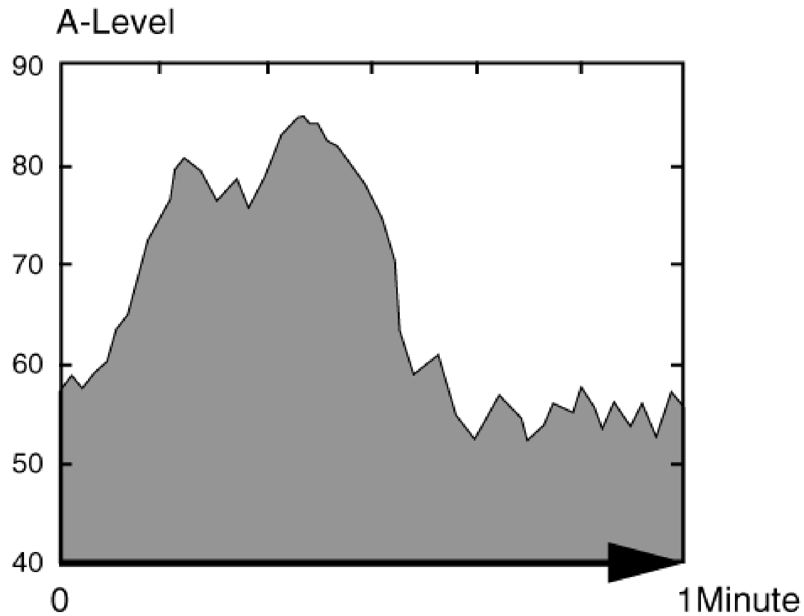
Figure H-2 Common Environmental Sound Levels, in dBA



Source: HMMH (Aircraft noise levels from FAA Advisory Circular 36-3H)

An additional dimension to environmental noise is that A-weighted levels vary with time. For example, the sound level increases as an aircraft approaches, then falls and blends into the background as the aircraft recedes into the distance (though even the background varies as birds chirp or the wind blows or a vehicle passes by). Figure H-3 illustrates this concept.

Figure H-3 Variations in the A-Weighted Sound Level Over Time



Source: HMMH

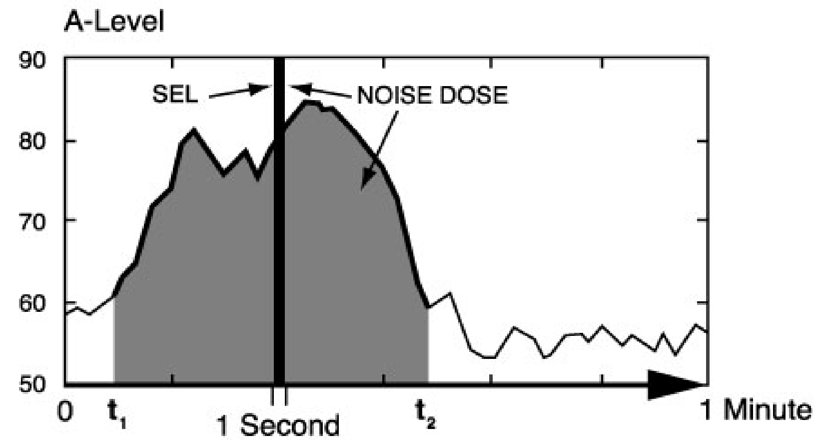
Maximum A-Weighted Noise Level, L_{max}
The variation in noise level over time often makes it convenient to describe a particular noise "event" by its maximum sound level, abbreviated as L_{max}. In the figure above, it is approximately 85 dBA.

The maximum level describes only one dimension of an event; it provides no information on the cumulative noise exposure. In fact, two events with identical maxima may produce very different total exposures. One may be of very short duration, while the other may continue for an extended period and be judged much more annoying. The next measure corrects for this deficiency.

Sound Exposure Level (SEL)
The most frequently used measure of noise exposure for an individual aircraft noise event (and the measure that FAA Part 150 regulations specifies for this purpose) is the SEL. SEL is a measure of the total noise energy produced during an event, from the time when the A-weighted sound level first exceeds a threshold level (normally just above the background or ambient noise) to the time that the sound level drops back down below the threshold. To allow comparison of noise events with very different durations, SEL “normalizes” the duration in every case to one second; that is, it is expressed as the steady noise level with just a one-second duration that includes the same amount of noise energy as the actual longer duration, time-varying noise. In lay terms, SEL “squeezes” the entire noise event into one second.

Figure H-4 depicts this transformation. The shaded area represents the energy included in an SEL measurement for the noise event, where the threshold is set to 60 dBA. The dark shaded vertical bar, which is 90 dBA high and just one second long (wide), contains exactly the same sound energy as the full event.

Figure H-4 Sound Exposure Level



Source: HMMH

Because the SEL is normalized to one second, it will always be larger than the L_{max} for an event longer than one second. In this case, the SEL is 90 dB; the L_{max} is approximately 85 dBA. For most aircraft overflights, the SEL is normally on the order of 7 to 12 dB higher than L_{max}. Because SEL takes duration into account, longer exposure to relatively slow, quiet aircraft, such as propeller models, can have the same or higher SEL than shorter exposure to faster, louder planes, such as corporate jets.

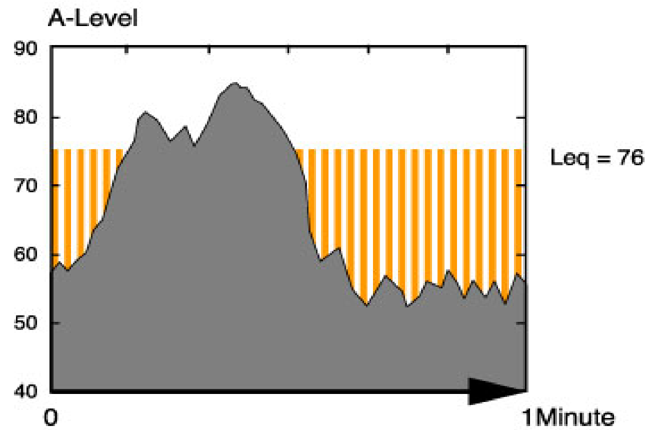
Equivalent Sound Level (L_{eq})

The L_{max} and SEL quantify the noise associated with individual events. The remaining metrics in this section describe longer-term cumulative noise exposure that can include many events.

The Equivalent Sound Level (L_{eq}) is a measure of exposure resulting from the accumulation of A-weighted sound levels over a particular period of interest; for example, an hour, an eight hour school day, nighttime, or a full 24-hour day. Because the length of the period can differ, the applicable period should always be identified or clearly understood when discussing the metric. Such durations are often identified through a subscript, for example $L_{eq(8)}$ or $L_{eq(24)}$.

L_{eq} is equivalent to the constant sound level over the period of interest that contains as much sound energy as the actual time-varying level. This is illustrated in Figure H-5. Both the solid and striped shaded areas have a one-minute L_{eq} value of 76 dB. It is important to recognize, however, that the two signals (the constant one and the time-varying one) would sound very different in real life. Also, be aware that the "average" sound level suggested by L_{eq} is not an arithmetic value, but a logarithmic, or "energy-averaged" sound level. Thus, loud events dominate L_{eq} measurements.

Figure H-5 Example of a One Minute Equivalent Sound Level



Source: HMMH

In airport noise studies, L_{eq} is often presented for consecutive one-hour periods to illustrate how the exposure rises and falls throughout a 24-hour period, and how individual hours are affected by unusual activity, such as rush hour traffic or a few loud aircraft.

Time Above (TA)

Time Above (TA) is a metric that gives the duration, in minutes, for which aircraft-related noise exceeds a specified A-weighted sound level during a given period. The measure is referred to generally as TA. For the *2011 ESPR*, three threshold sound levels are used in the analysis: 65, 75, and 85 dBA. These times are computed using the Federal Aviation Administration (FAA)-approved Integrated Noise Model (INM).

Time Above Night

Identical to TA, except it is computed for only the 9 hour period between 10 PM and 7 AM.

Day-Night Average Sound Level (DNL)

Virtually all studies of aircraft noise rely on a slightly more complicated measure of noise exposure that describes cumulative noise exposure during an average annual day: the DNL. The EPA identified DNL as the most appropriate means of evaluating airport noise based on the following considerations:[1]

1. The measure should be applicable to the evaluation of pervasive long-term noise in various defined areas and under various conditions over long periods of time.
2. The measure should correlate well with known effects of the noise environment and on individuals and the public.
3. The measure should be simple, practical, and accurate. In principal, it should be useful for planning as well as for enforcement or monitoring purposes.
4. The required measurement equipment, with standard characteristics, should be commercially available.
5. The measure should be closely related to existing methods currently in use.

1 Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," U. S. EPA Report No. 550/9-74-004, March 1974

6. The single measure of noise at a given location should be predictable, within an acceptable tolerance, from knowledge of the physical events producing the noise.
7. The measure should lend itself to small, simple monitors, which can be left unattended in public areas for long periods of time.

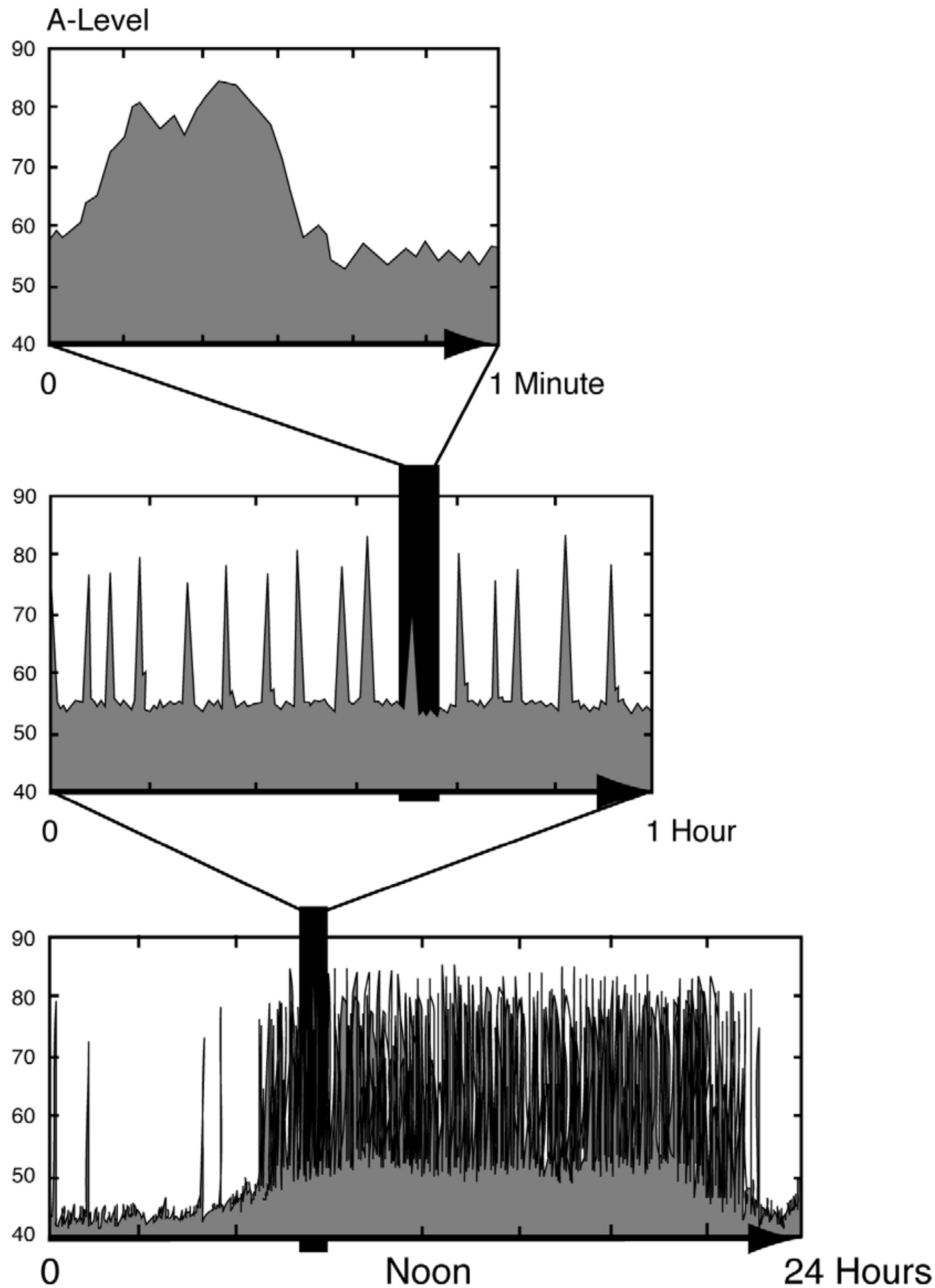
Most federal agencies dealing with noise have formally adopted DNL. The Federal Interagency Committee on Noise (FICON) reaffirmed the appropriateness of DNL in 1992. The FICON summary report stated: "There are no new descriptors or metrics of sufficient scientific standing to substitute for the present DNL cumulative noise exposure metric."

The DNL represents noise as it occurs over a 24-hour period with one important exception: DNL treats nighttime noise differently from daytime noise. In determining DNL, it is assumed that the A-weighted levels occurring at night (defined as 10 PM to 7 AM) are 10 dB louder than they really are. This 10 dB penalty is applied to account for greater sensitivity to nighttime noise, and the fact that events at night are often perceived to be more intrusive because nighttime ambient noise is less than daytime ambient noise.

Figure H-6 illustrated the A-weighted sound level due to an aircraft fly-over as it changed with time. The top frame of Figure H-6 repeats this figure. The shaded area reflects the noise dose that a listener receives during the one-minute period of the sample. The center frame of Figure H-6 includes this one minute sample within a full hour. The shaded area represents the noise during that hour with 16 noise events, each producing an SEL. Similarly, the bottom frame includes the one-hour interval within a full 24 hours. Here the shaded area represents the listener's noise dose over a complete day. Note that several overflights occur at a time when the background noise drops some 10 dB, to approximately 45 dBA.

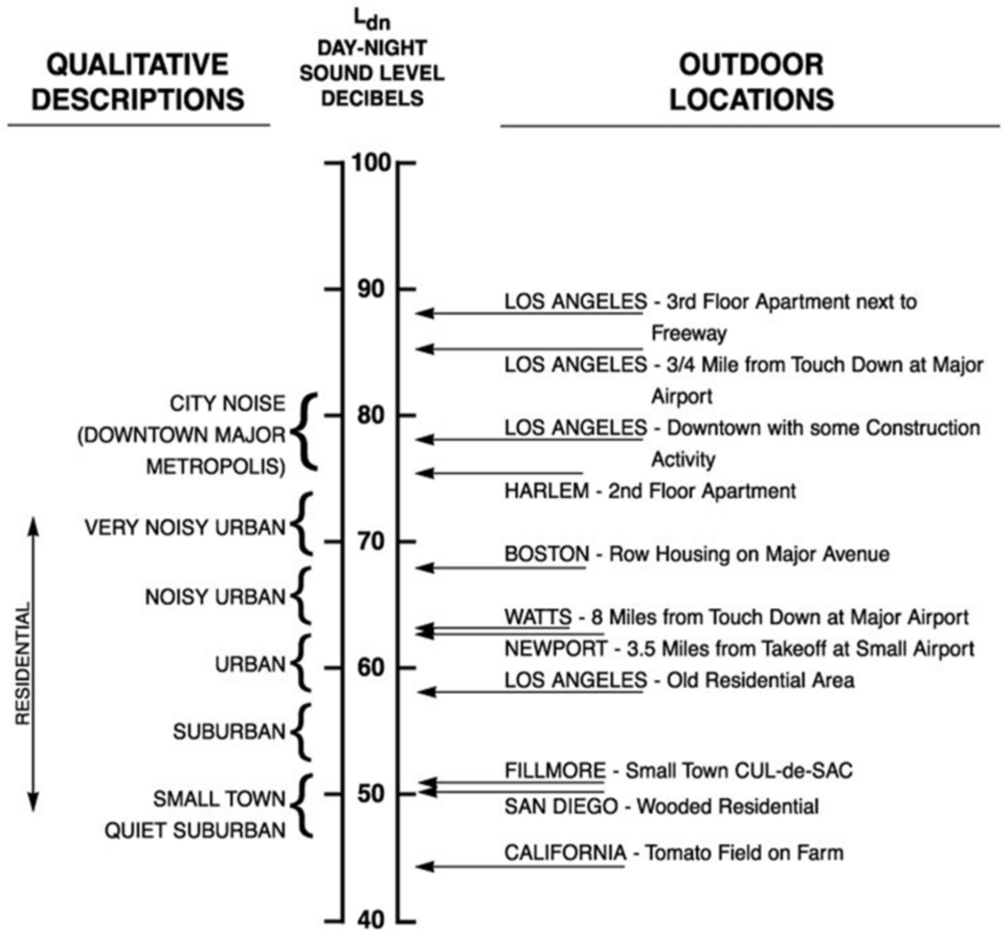
DNL can be measured or estimated. Measurements are practical only for obtaining DNL values for relatively limited numbers of points, and, in the absence of a permanently installed monitoring system, only for relatively short time periods. Most airport noise studies are based on computer-generated DNL estimates, determined by accounting for all of the SELs from individual events which comprise the total noise dose at a given location. Computed DNL values are often depicted in terms of equal-exposure noise contours (much as topographic maps have contours of equal elevation). Figure H-7 depicts typical DNL values for a variety of noise environments.

Figure H-6 Daily Noise Dose



Source: HMMH

Figure H-7 Examples of Day-Night Average Sound Levels (DNL)



Source: United States Environmental Protection Agency, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974, p. 14.

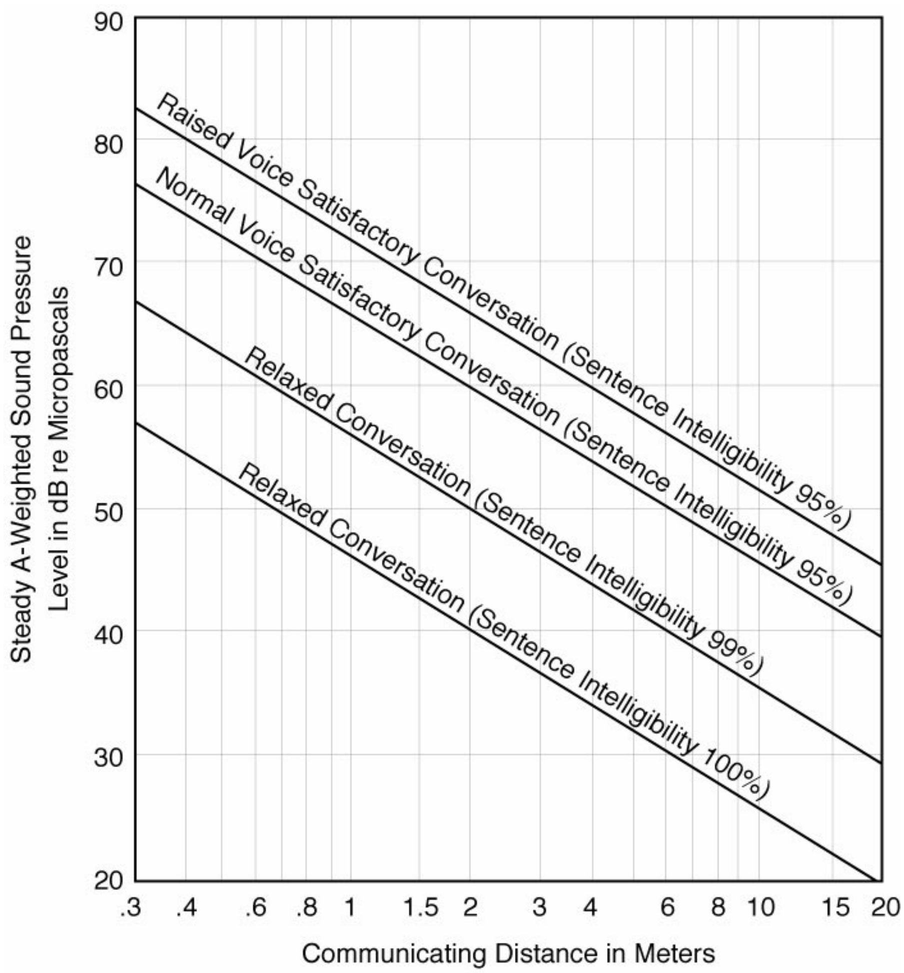
The Effects of Aircraft Noise on People

To residents around airports, aircraft noise can be an annoyance and a nuisance. It can interfere with conversation and listening to television, it can disrupt classroom activities in schools and it can disrupt sleep. Relating these effects to specific noise metrics helps in the understanding of how and why people react to their environment.

Speech Interference

A primary effect of aircraft noise is its tendency to drown out or "mask" speech, making it difficult to carry on a normal conversation. The sound level of speech decreases as the distance between a talker and listener increases. As the background sound level increases, it becomes harder to hear speech. Figure H-8 presents typical distances between talker and listener for satisfactory outdoor conversations, in the presence of different steady A-weighted background noise levels for raised, normal, and relaxed voice effort. As the background level increases, the talker must raise his/her voice, or the individuals must get closer together to continue talking.

Figure H-8 Outdoor Speech Intelligibility



Source: United States Environmental Protection Agency, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974, p. D-5.

As indicated in the figure, "satisfactory conversation" does not always require hearing every word; 95 percent intelligibility is acceptable for many conversations. Listeners can infer a few unheard words when they occur in a familiar context. However, in relaxed conversation, we have higher expectations of hearing speech and generally require closer to 100 percent intelligibility. Any combination of talker-listener distances and background noise that falls below the bottom line in Figure H-8 (thus assuring 100 percent intelligibility) represents an ideal environment for outdoor speech communication and is considered necessary for acceptable indoor conversation as well.

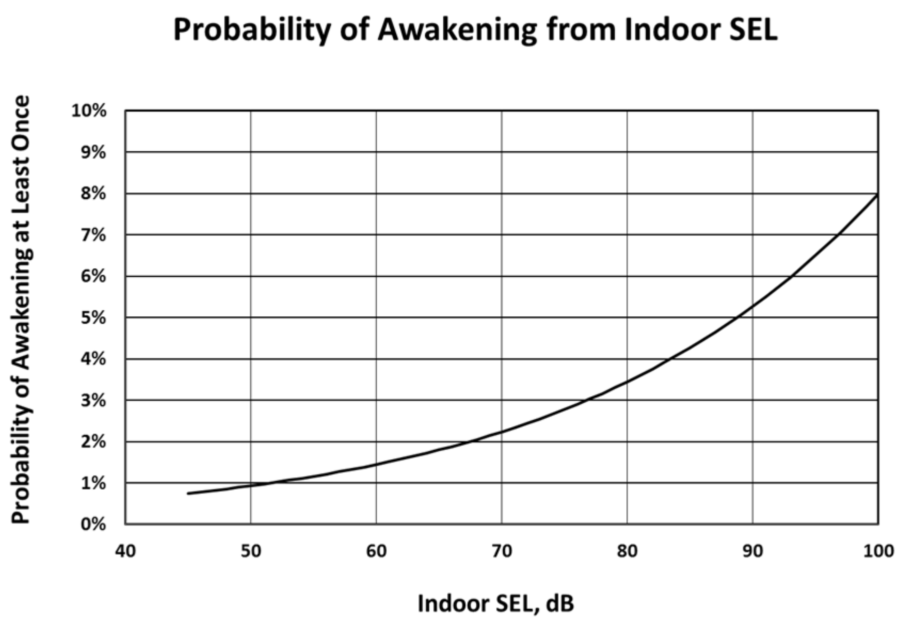
One implication of the relationships in Figure H-8 is that for typical communication at distances of 3 or 4 feet (1 to 1.5 meters), acceptable outdoor conversations can be carried on in a normal voice as long as the background noise outdoors is less than about 65 dBA. If the noise exceeds this level, as might occur when an aircraft passes overhead, intelligibility would be lost unless vocal effort were increased or communication distance were decreased.

Indoors, typical distances, voice levels, and intelligibility expectations generally require a background level less than 45 dBA. With windows partly open, housing generally provides about 12 dBA of interior-to-exterior noise level reduction. Thus, if the outdoor sound level is 60 dBA or less, there is a reasonable chance that the resulting indoor sound level will afford acceptable conversation inside. With windows closed, 24 dB of attenuation is typical.

Sleep Interference

Research on sleep disruption from noise has led to widely varying observations. In part, this is because (1) sleep can be disturbed without awakening, (2) the deeper the sleep the more noise it takes to cause arousal, (3) the tendency to awaken increases with age, and other factors. Figure H-9 shows probability of awakening at least once from an indoor SEL.

Figure H-9 Probability of Awakening at Least Once from Indoor Noise Event



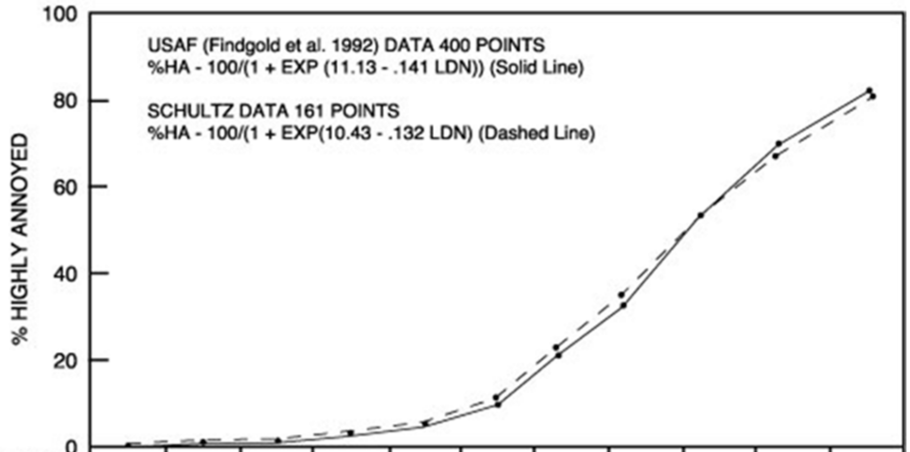
Source: ANSI S12.9-2008/Part 6, Quantities and Procedures for Description and Measurement of Environmental Sound — Part 6: Methods for Estimation of Awakenings Associated with Outdoor Noise Events Heard in Homes; Equation 1

Figure H-9 depicts indoor SEL as the measure of noise exposure; recent work supports the use of this metric in assessing sleep disruption. An indoor SEL of 80 dB results in a maximum of approximately 3.5 percent awakening. Assuming the typical windows-open interior-to-exterior noise level reduction of approximately 12 dB, and a typical L_{max} value for an aircraft flyover is 12 dB lower than the SEL value, an interior SEL of 80 dB roughly translates into an exterior L_{max} of the same value.

Community Annoyance

Social survey data make it clear that individual reactions to noise vary widely for a given noise level. Nevertheless, as a group, people's aggregate response is predictable and relates well to measures of cumulative noise exposure such as DNL. Figure H-10 shows a widely recognized relationship between environmental noise and annoyance.

Figure H-10 Percentage of People Highly Annoyed



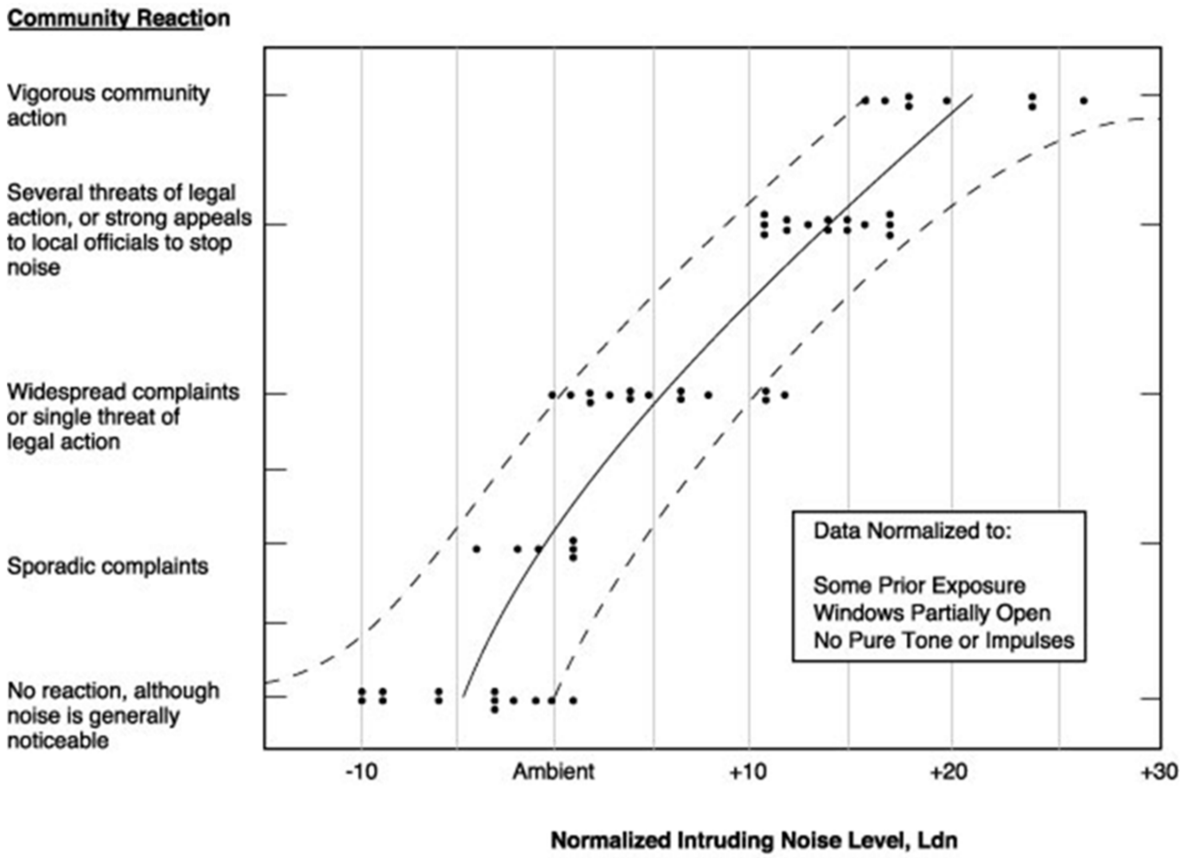
Day - Night Average Sound Level in dB		40	45	50	55	60	65	70	75	80	85	100
Calculated %HA Points	USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
	SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81

Source: Federal Interagency Committee on Noise. "Federal Agency Review of Selected Airport Noise Analysis Issues". August 1992. (From data provided by USAF Armstrong Laboratory). pp. 3-6

Based on data from 18 surveys conducted worldwide, the curve indicates that at levels as low as DNL 55, approximately five percent of the people will still be highly annoyed, with the percentage increasing more rapidly as exposure increases above DNL 65.

Separate work by the EPA has shown that overall community reaction to a noise environment can also be related to DNL. This relationship is shown in Figure H-11. Levels have been normalized to the same set of exposure conditions to permit valid comparisons between ambient noise environments. Data summarized in Figure H-11 suggest that little reaction would be expected for intrusive noise levels 5 dB below the ambient, while widespread complaints can be expected as intruding noise exceeds background levels by about 5 dB. Vigorous action is likely when the background is exceeded by 20 dB.

Figure H-11 Community Reaction as a Function of Outdoor DNL



Source: Wyle Laboratories, Community Noise, prepared for the U.S. Environmental Protection Agency, Office of Noise Abatement and Control, Washington, D.C. 20406, December 1971, page 63.

Logan Airport RealContours™ Data Inputs

For this *2011 ESPR*, Massachusetts Port Authority (Massport) has produced a set of noise contours, time above (TA) noise metrics, and population counts for 2011 using the pair of software packages RealProfiles™ and RealContours™. This software incorporates the latest version of the FAA Integrated Noise Model (INM) Version 7.0c as the computational "engine" for calculating noise, but uses individual flight tracks taken directly from the Massport Noise and Operations Management System (NOMS) rather than relying on consolidated data summaries. For 2011, the NOMS retained suitable data for 350,443 flights; all of these were used in the noise model directly.

Introduction

Standard INM methodology involves development of operational inputs and calculation of the day-night average sound level (DNL) for a prototypical average annual day. This approach requires manually collecting, refining, and entering the enormous amount of data related to a full year of activity at an airport. For example, the model inputs may include an aircraft fleet mix with several dozen representative aircraft types, numerous representative flight tracks (on the order of 100 to 300 is common for an airport comparable to Logan Airport), and runway use and flight track use percentages for three or four categories of aircraft types with similar performance characteristics.

This approach meets accepted professional standards, and reduces the effort and cost that would be associated with manually entering the parameters for every actual operation. However, it represents a significant simplification of the extraordinary diversity of actual aircraft operations over a year. It also does not take full advantage of the investment that Massport has made in installing and maintaining a state-of-the-art radar system[2], which automatically collects flight track data and flight identification data for all operations at the Airport and feeds the new NOMS.

For this report, Massport has selected an INM pre-processor, named RealContours™, which takes maximum possible advantage of both the INM's capabilities and the investment that Massport has made in operations monitoring. RealContours™ automates the process of preparing the INM inputs directly from the actual flight operations, and permits airports to model the full diversity of activity as precisely as possible, at a cost equivalent to the more simplified manual approach. RealContours™ improves the precision of modeling by utilizing operations monitoring results in five key areas:

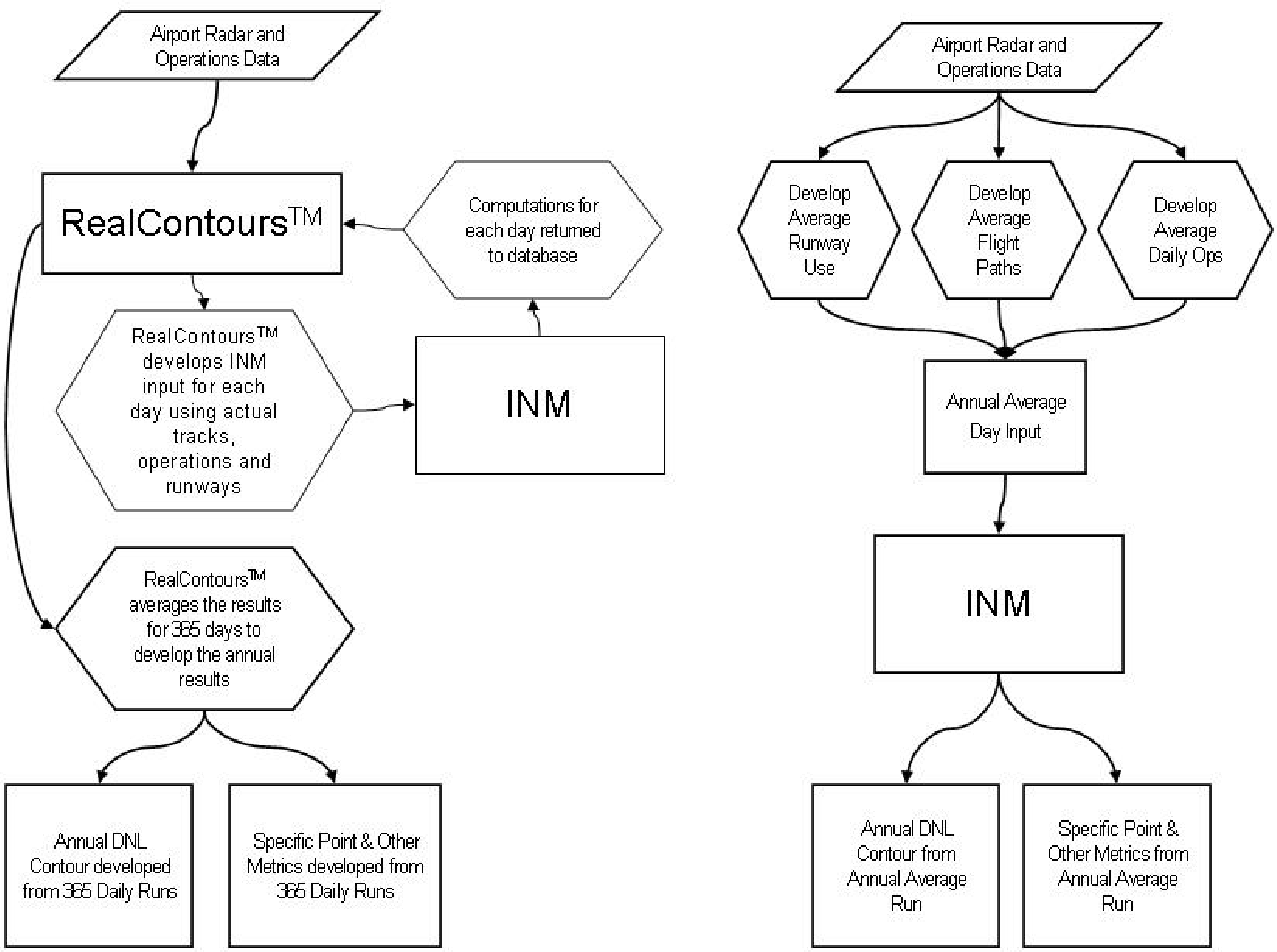
- Directly converts the flight track for every identified aircraft operation to an INM track, rather than assigning all operations to a limited number of prototypical tracks.
- Models each operation on the specific runway that it actually used, rather than applying a generalized distribution to broad ranges of aircraft types.
- Models each operation in the modeling time frame that it occurred which takes in account delays at the airport during the year.
- Selects the specific airframe and engine combination to model, on an operation-by-operation basis, based on the registration data for each flight wherever possible, otherwise the published compositions of the fleets of the specific airlines operating at Logan Airport are used.
- Uses each aircraft's actual performance and altitude profile to develop inputs to the model which define the actual arrival or departure profile.

2 For 2010, the Massport system utilizes the Airscene.com product of Era Corporation. During 2010 Era Corporations was acquired by ITT Corporation.

As defined in the INM 7.0 User's Guide, the annual day-night average sound level (YDNL) is used for quantifying airport noise. The YDNL is the 365-day average DNL. To use this definition to model noise in INM, one would have to run 365 cases of the model and average the results. Since this is time consuming and impractical, the current practice is to average the 365 days of data before the run and design one input file.[3] However, RealContours™ accomplishes this task by using the actual radar data to develop INM input files for each day of the year and then averaging the results to obtain the annual contour.

Figure H-12 provides a schematic representation of the RealContours™ noise modeling process compared to the standard INM process.

Figure H-12 Schematic Noise Modeling Process (Standard INM vs. RealContours™)



3 Federal Aviation Administration Integrated Noise Model (INM) Version 7.0 User's Guide, April 2007, p. 12.

2011 Radar Data

Logan Airport's radar data provides the key to the RealContours™ system. Since February 2004, Massport has collected Passive Surveillance Radar System (PASSUR) radar data, which supplies information to the Airport's web-based Airport Monitor software. This dataset has been used for the *2004 ESPR* through the *2008 Environmental Data Report (EDR)*. Beginning with the *2009 EDR*, Massport utilized the radar data from its NOMS system. This radar data is called multilateration radar since it collects data from multiple ground stations (Massport has eight sensors) deployed around the Airport. The positioning data from all of these sensors is correlated to provide better coverage in areas where the traditional FAA radar has limitations and provides a more complete set of points to define each track. Traditional radar provides points every four to five seconds where the multilateration provides data every second. The new system was able to collect 365 complete days of data for 2011 with approximately 95 percent of these tracks usable for the development of the noise exposure contours.

Fleet Mix

The 2011 radar data first were processed to establish a baseline set of operations. After processing 365 days of radar data, 350,343 flight tracks with sufficient data were identified to use as the baseline for the 2011 contour. The operations from these tracks were then scaled upwards by airline and aircraft type to match the reported totals for 2011. Table H-1 provides the scaled annual operations, as modeled, by aircraft type. The INM aircraft types modeled by RealContours™ match the types listed in Table H-1.

Runway Use

RealContours™ obtains its runway use information directly from the radar data based on the actual runways, which were used each day throughout the modeled year. The runway use presented here is broken into six representative aircraft groups listed below (see Table H-2):

- Heavy Jet A – B747s, A340s, DC-8s
- Heavy Jet B – B767s, B777s, A300s, A310s, A330s, DC-10s, L1011s, MD-11s
- Light Jet A – B717s, B727s, DC-9s, F100s, MD-90s
- Light Jet B – B737s, B757s, A319s, A320s, B-146s, MD-80s, E190
- Regional Jet (RJ) – E135, E145, E170, CRJ2, CRJ7, CRJ9, J328 and Corporate Jets
- Turboprops and Piston Aircraft (Non-Jets)

The runway use has been grouped in this format to allow comparison with prior years. However, the definition of regional jet (RJ) used in the EDR was changed to represent aircraft with less than 80 seats which shifted the E190 to the Light Jet B category.[4]

Table H-2 shows the runway use that was used to model the 2011 noise conditions. As described above, turbojet aircraft in the table were grouped into different categories for reporting purposes. Because the 2011 contour developed using RealContours™ reflects the individual use of the runways by each INM aircraft type, it accurately represents Logan Airport's noisiest aircraft by modeling them on the actual runways that they used during the year. The modeled runway use for each particular aircraft type may be different than the overall group runway use presented in Table H-2.

4 In the *2010 EDR*, the CRJ9 aircraft was incorrectly identified as having 90 seats. The aircraft in operation at Logan Airport has 78 seats in a two-class configuration.

Table H-1 2011 Annual Modeled Operations						
	Runway	Arrivals		Departures		
INM Type	Use Group	Day	Night	Day	Night	Total
Commercial Jet Operations						
74720B	HJA	1.0	0.0	1.0	0.0	2.0
747400	HJA	1010.8	16.5	698.7	328.6	2054.7
A340-211	HJA	1051.2	2.0	851.3	201.9	2106.4
A340-642	HJA	566.8	2.1	549.6	19.3	1137.8
DC870	HJA	161.8	117.7	4.1	275.4	558.9
767300	HJB	473.0	112.6	484.4	101.2	1171.2
767400	HJB	355.2	4.1	285.7	73.5	718.4
767CF6	HJB	13.2	3.1	13.2	3.1	32.6
767JT9	HJB	1.2	0.0	0.0	1.2	2.4
777200	HJB	335.2	61.0	389.8	6.4	792.5
777300	HJB	5.0	0.0	5.0	0.0	10.0
A300-622R	HJB	183.4	590.0	327.7	445.6	1546.6
A310-304	HJB	200.7	12.4	28.4	184.7	426.2
A330-301	HJB	1212.3	5.1	1192.0	22.7	2432.1
A330-343	HJB	131.1	0.0	63.9	69.8	264.8
DC1010	HJB	388.5	291.9	207.3	454.9	1342.7
DC1030	HJB	179.0	93.6	96.6	194.2	563.4
MD11GE	HJB	21.1	16.1	27.2	16.7	81.2
MD11PW	HJB	9.1	6.0	4.2	4.2	23.5
717200	LJA	3952.4	574.1	3995.4	531.2	9053.0
727EM2	LJA	235.2	85.7	183.2	137.7	641.7
DC95HW	LJA	310.8	73.8	337.9	46.7	769.2
MD9025	LJA	49.0	0.0	60.9	0.0	109.9
MD9028	LJA	107.2	2.0	95.4	2.0	206.7
7373B2	LJB	566.3	95.5	568.1	93.7	1323.5
737400	LJB	957.8	63.6	967.9	53.5	2042.8
737500	LJB	7113.5	591.5	6795.0	910.0	15410.0
737700	LJB	8769.4	1695.5	9182.8	1282.1	20929.7
737800	LJB	8308.2	1863.9	9165.6	1006.5	20344.2
737N17	LJB	6.6	0.7	6.3	0.0	13.6
737N9	LJB	0.7	0.0	1.9	0.0	2.6
757300	LJB	4.1	1.0	5.1	0.0	10.1
757PW	LJB	6118.5	1369.3	6510.4	994.4	14992.6
757RR	LJB	4872.1	1348.9	5372.5	831.5	12425.1
A319-131	LJB	35299.6	4675.6	35127.0	4848.2	79950.5

Note: Some totals may not match due to rounding.

Table H-1 2011 Annual Modeled Operations (Continued)

INM Type	Runway Use Group	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total
Commercial Jet Operations (Continued)						
A320-211	LJB	3132.3	765.3	3341.9	541.6	7781.1
A320-232	LJB	14808.5	4975.3	17456.3	2341.5	39581.5
A321-232	LJB	314.1	294.0	409.8	198.3	1216.2
MD82	LJB	40.7	2.1	42.7	0.0	85.4
MD83	LJB	1117.4	115.3	1185.2	47.5	2465.5
CRJ9-ER	RJ	5958.0	356.9	5463.1	890.3	12668.3
CRJ9-LR	RJ	1722.8	281.1	1606.8	358.6	3969.3
CIT3	RJ	1.0	0.0	1.0	0.0	2.0
CL600	RJ	99.4	16.7	100.8	16.3	233.3
CL601	RJ	7495.6	361.4	7536.3	319.8	15713.2
CNA560XL	RJ	4.2	0.0	4.2	0.0	8.5
CNA55B	RJ	12.9	1.1	13.0	1.0	28.1
CNA750	RJ	14.1	1.2	14.1	1.2	30.6
CNA680	RJ	16.3	0.0	15.3	1.0	32.6
EMB145	RJ	3632.5	146.5	3158.9	653.5	7591.4
EMB14L	RJ	2209.1	54.4	1987.5	242.6	4493.6
F10062	RJ	22.5	1.5	22.5	1.5	47.9
GIIB	RJ	2.0	0.0	2.0	0.0	4.1
GIV	RJ	27.6	5.7	28.9	4.4	66.6
GV	RJ	22.4	2.0	23.4	1.0	48.9
LEAR25	RJ	0.0	0.8	0.0	0.8	1.7
LEAR35	RJ	41.6	2.6	41.0	3.2	88.5
MU3001	RJ	3.5	0.0	3.5	0.0	7.1
Commercial Jets Subtotal		123613.7	21155.5	126007.8	18761.5	289538.6
Commercial Non-Jet Operations						
BEC58P	NJ	17202.1	669.7	17776.6	95.1	35743.5
C130	NJ	0.5	0.0	0.5	0.0	1.0
CNA208	NJ	170.4	24.4	178.7	16.1	389.5
CNA20T	NJ	0.0	1.0	1.0	0.0	2.0
CNA441	NJ	14.2	1.0	14.1	1.1	30.5
DHC6	NJ	0.1	0.0	0.1	0.0	0.1
DHC8	NJ	809.2	0.0	802.1	7.1	1618.4
DHC830	NJ	2033.1	180.2	1976.3	236.9	4426.4
DO228	NJ	4.5	0.0	4.0	0.5	9.0
GASEPF	NJ	4.2	1.0	2.5	2.7	10.5
GASEPV	NJ	5.0	0.0	5.0	0.0	10.1
PA31	NJ	80.2	186.5	84.7	182.0	533.4
SF340	NJ	4064.7	82.0	4107.9	38.8	8293.3
Commercial Non-Jet Operations Subtotal		24444.2	1149.5	25009.8	584.0	51187.4
Commercial Aircraft Total		148058.0	22305.0	151017.6	19345.4	340726.0
General Aviation (GA) Operations						
74720B	HJA	3.8	0.0	3.8	0.0	7.6
747400	HJA	1.3	0.0	1.3	0.0	2.5
DC870	HJA	3.8	1.3	0.0	5.0	10.1
767300	HJB	6.0	1.3	5.7	1.6	14.6
767CF6	HJB	3.8	0.0	2.5	1.3	7.6

Notes: BEC58P is the INM substitution for the Cessna 402.
The CRJ9-ER in the RJ category is the CRJ700 aircraft.
Some totals may not match due to rounding.

Table H-1 2011 Annual Modeled Operations (Continued)

INM Type	Runway Use Group	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total
General Aviation Operations (Continued)						
767JT9	HJB	1.3	0.0	1.3	0.0	2.5
A330-301	HJB	3.5	1.3	4.8	0.0	9.6
DC1010	HJB	0.0	1.3	0.0	0.0	1.3
DC1030	HJB	0.0	0.0	0.0	1.3	1.3
MD11GE	HJB	1.3	0.0	1.3	0.0	2.5
727EM1	LJA	1.3	2.5	1.3	2.5	7.6
727EM2	LJA	2.5	1.3	3.8	0.0	7.6
7373B2	LJB	3.4	1.7	5.0	0.0	10.1
737500	LJB	1.3	0.0	1.3	0.0	2.5
737N17	LJB	1.3	0.0	2.5	0.0	3.8
737N9	LJB	1.3	0.0	0.0	0.0	1.3
757PW	LJB	5.0	0.0	3.8	1.3	10.1
757RR	LJB	1.3	0.0	1.3	0.0	2.5
A319-131	LJB	6.7	2.1	6.3	2.5	17.6
A320-211	LJB	2.5	0.0	1.3	0.0	3.8
A320-232	LJB	0.0	0.0	1.3	0.0	1.3
MD81	LJB	2.3	0.0	1.3	1.0	4.5
MD82	LJB	1.3	1.3	2.5	0.0	5.0
MD83	LJB	5.0	0.0	5.0	0.0	10.1
CIT3	RJ	73.3	8.4	76.0	5.8	163.5
CL600	RJ	858.5	94.8	880.4	71.2	1904.9
CL601	RJ	883.5	71.1	871.2	85.3	1911.1
CNA500	RJ	37.4	14.2	36.2	10.1	97.9
CNA510	RJ	50.3	2.5	42.8	10.1	105.7
CNA55B	RJ	410.4	61.2	410.4	66.4	948.4
CNA750	RJ	677.1	71.4	691.9	56.6	1497.1
CNA525C	RJ	273.0	17.4	275.9	14.4	580.7
CNA560E	RJ	167.8	13.9	164.4	12.6	358.7
CNA560U	RJ	228.6	22.8	235.1	21.1	507.6
CNA560XL	RJ	1133.2	119.8	1143.5	109.5	2505.9
CNA680	RJ	516.5	38.0	530.6	23.9	1109.0
ECLIPSE500	RJ	17.1	13.1	16.4	13.8	60.4
EMB145	RJ	69.8	11.7	76.5	5.0	163.0
F10062	RJ	427.6	24.2	434.1	17.6	903.5
FAL20	RJ	2.5	0.0	2.7	0.0	5.2
GIV	RJ	648.9	88.8	661.1	76.5	1475.3
GV	RJ	515.2	64.3	520.7	58.9	1159.1
IA1125	RJ	128.4	32.7	148.3	12.7	322.2
MU3001	RJ	744.4	59.5	744.8	59.2	1607.8
LEAR25	RJ	11.3	0.0	11.3	1.3	23.9
LEAR35	RJ	1570.5	170.0	1559.9	178.9	3479.2
SABR80	RJ	1.3	0.0	1.3	0.0	2.5
BEC58P	NJ	806.2	79.0	813.2	72.0	1770.4
C130	NJ	1.3	0.0	1.3	0.0	2.5
CNA172	NJ	47.8	1.3	41.5	7.6	98.2
CNA206	NJ	101.6	0.0	103.2	0.0	204.8

Note: Some totals may not match due to rounding.

Table H-1 2011 Annual Modeled Operations (Continued)						
INM Type	Runway Use Group	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total
General Aviation Operations (Continued)						
CNA208	NJ	1002.9	86.7	1033.2	56.4	2179.1
CNA20T	NJ	22.8	1.4	21.4	1.3	46.9
CNA441	NJ	327.1	17.3	307.2	37.2	688.8
DHC6	NJ	0.0	1.3	1.3	0.0	2.5
DHC830	NJ	3.8	0.0	3.8	0.0	7.6
DO228	NJ	195.6	17.6	193.7	19.5	426.3
DO328	NJ	1.3	0.0	1.3	0.0	2.5
EMB120	NJ	1.3	0.0	0.0	1.3	2.5
GASEPF	NJ	13.8	0.0	20.1	0.0	34.0
GASEPV	NJ	408.7	7.9	408.6	8.0	833.2
PA28	NJ	20.1	0.0	12.6	1.3	34.0
PA30	NJ	3.8	0.0	3.8	0.0	7.6
PA31	NJ	50.3	2.5	50.3	2.5	105.7
PA42	NJ	12.6	0.0	12.6	0.0	25.2
SD330	NJ	295.6	21.5	288.2	28.9	634.3
SF340	NJ	1.3	0.0	1.3	0.0	2.5
General Aviation Total		12873.5	1257.0	12959.6	1170.9	28261.0
Grand Total		160931.5	23562.0	163977.2	20516.3	368987.0

Source: HMMH, 2011.
Notes: Annual operations modeled in the 2011 Annual contour.
Some totals may not match due to rounding.
HJA, HJB Heavy Jets A and B
LJA, LJB Light Jets A and B
RJ Regional Jets
NJ Non-jets

Comparing Table H-2 with the similar Table H-2 in the *2010 EDR*, departure use of Runway 33L and 14 decreased during the day and night for all jet groups and increased for Runways 9 and 22R during the day and night for all jet groups. Runway 27 departures also decreased during the day and night for all jet groups except for a raise of 0.05 percent in daytime Heavy Jet Group B. For departures, the largest increase for Heavy Jet Group A was on Runway 4R during the day (26.33 percent in 2011 compared to 15.75 percent in 2010[5]) and the largest decrease was on Runway 15R during the night (32.60 percent in 2011 compared to 52.62 percent in 2010). For Heavy Jet-Group B departures, the largest increase was on Runway 22R during the night (24.17 percent in 2011 compared to 14.23 percent in 2010) and the largest decrease was on Runway 15R during the night (29.08 percent in 2011 compared to 42.37 percent in 2010).

5 The Heavy Jet A Day departure values reported in the *2010 EDR* are incorrect. The correct values are: 04L -0.00%, 04R – 15.75%, 09 – 6.99%, 14 – 0.00%, 15L – 0.00%, 15R – 16.21%, 22L – 10.99%, 22R – 22.75%, 27 – 0.48%, 32 – 0.00%, 33L – 26.83%, 33R – 0.00%

Table H-2 2011 Modeled Runway Use by Aircraft Group

	ARRIVALS											
	Heavy Jets - Group A		Heavy Jets - Group B		Light Jets - Group A		Light Jets - Group B		Regional Jets		Turboprops (Non-jets)	
Runway	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
04L	0.22%	0.00%	0.35%	0.34%	5.72%	0.70%	5.56%	0.98%	18.46%	3.82%	28.93%	9.22%
04R	48.21%	26.85%	46.77%	26.47%	40.20%	33.61%	39.59%	29.30%	27.63%	29.09%	16.70%	21.91%
09	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
14	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15L	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
15R	0.19%	0.00%	0.35%	0.00%	0.38%	0.28%	0.31%	0.13%	0.33%	0.00%	0.24%	0.09%
22L	28.07%	35.38%	16.11%	31.34%	9.35%	33.94%	12.98%	33.80%	14.98%	28.89%	20.01%	36.46%
22R	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.19%	1.35%
27	13.98%	13.70%	27.20%	8.85%	35.18%	11.45%	32.55%	12.85%	26.78%	13.79%	19.76%	11.63%
32	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.25%	0.03%	3.19%	0.29%	4.00%	0.24%
33L	9.33%	24.07%	9.22%	33.00%	9.17%	20.02%	8.76%	22.90%	8.64%	24.12%	6.05%	18.66%
33R	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.11%	0.45%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

	DEPARTURES											
	Heavy Jets - Group A		Heavy Jets - Group B		Light Jets - Group A		Light Jets - Group B		Regional Jets		Turboprops (Non-jets)	
Runway	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
04L	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	24.26%	13.29%
04R	26.33%	10.93%	17.92%	5.46%	4.15%	2.52%	6.01%	5.04%	2.32%	4.04%	3.43%	5.55%
09	9.99%	11.14%	22.10%	19.41%	40.41%	24.02%	37.32%	23.49%	47.90%	26.80%	15.46%	9.55%
14	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.06%	0.00%
15L	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.18%	0.13%
15R	10.86%	32.60%	4.80%	29.08%	2.01%	28.01%	2.37%	24.46%	1.29%	31.46%	2.72%	25.19%
22L	12.94%	11.19%	6.47%	3.16%	1.36%	1.30%	1.99%	2.26%	0.52%	0.75%	0.70%	2.09%
22R	26.73%	20.27%	33.37%	24.17%	37.73%	22.41%	36.78%	26.70%	40.35%	28.23%	42.01%	28.09%
27	0.29%	1.76%	4.35%	3.59%	6.45%	12.05%	7.38%	8.27%	7.62%	8.72%	2.79%	2.34%
32	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
33L	12.85%	12.11%	10.97%	15.13%	7.88%	9.69%	8.15%	9.78%	0.00%	0.00%	8.39%	13.77%
33R	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: Massport, HMMH. 2011

Notes: Night for noise modeling is defined as 10 PM to 7 AM.
Nighttime runway restrictions are from 11 PM to 6 AM.
Values may not add to 100 percent due to rounding.

For Light Jets – Group A departures, the largest increase is on Runway 9 during the day (40.41 percent in 2011 compared to 28.8 percent in 2010) with the largest decrease on Runway 33L during the day (7.88 percent in 2011 compared to 19.33 percent in 2010). For Light Jets – Group B departures, the largest increase was on Runway 9 during the night (23.49 percent in 2011 compared to 13.67 percent in 2010) with the largest decrease on Runway 15R during the night (24.46 percent in 2011 compared to 38.26 percent in 2010). For RJ departures use on Runway 04R and Runway 22L increased between 2010 and 2011 for both day and night.

While Table H-2 presents runway use by aircraft groups, Table H-3 presents the total runway use by runway and time of day. The first section of the table displays the operations by runway and time of day for an average day. The second section displays the same information for the year and the last section displays the percent that each runway is used by operation type and time of day. Table H-3 shows that on an average day Runway 22R has the most departures (183.38 per day) and Runway 27 has the most arrivals (169.65 per day). At night, Runway 22R has the most departures (14.65 per day) but Runway 22L has the most arrivals (21.63 per day). Overall, the Airport continued to favor a north-south operating flow in 2011 as shown with the percentage of jet departures by operating direction in Figure 6-5 of *Chapter 6, Noise Abatement.*

Table H-3 Summary of Jet and Non-Jet Aircraft Runway Use

	Runway												
	4L	4R	9	14[2]	15L	15R	22L	22R	27	32	33L	33R	Total
2011 Daily Operations													
Departures Day	18.79	24.56	152.38	0.06	0.14	10.83	7.96	168.73	28.58	--	37.22	--	449.25
Departures Night	0.30	2.87	12.51	0.00	0.00	14.48	1.40	14.65	4.22	--	5.78	--	56.21
Arrivals Day	49.53	151.04	--	--	0.01	1.33	64.83	2.42	128.55	5.73	36.62	0.84	440.91
Arrivals Night	1.04	18.61	--	--	0.00	0.08	21.63	0.05	8.13	0.04	14.96	0.02	64.55
Total Daily Operations	69.65	197.08	164.88	0.06	0.16	26.72	95.82	185.85	169.49	5.76	94.58	0.86	1010.92
2011 Annual Operations													
Departures Day	6,858	8,965	55,618	21	52	3,953	2,905	61,587	10,433	--	13,584	--	163,977
Departures Night	108	1,047	4,565	0	1	5,285	510	5,347	1,541	--	2,111	--	20,516
Arrivals Day	18,078	55,131	--	--	4	486	23,664	884	46,921	2,091	13,366	307	160,931
Arrivals Night	379	6,793	--	--	0	28	7,896	19	2,969	13	5,459	6	23,562
Total Annual Operations	25,423	71,936	60,183	21	57	9,752	34,975	67,837	61,864	2,104	34,521	313	368,987
2011 Operations Percentage													
Percentage Departures Day	4%	6%	34%	<1%	<1%	2%	2%	38%	6%	0%	7%	0%	100%
Percentage Departures Night	1%	5%	22%	0%	<1%	26%	3%	26%	8%	0%	9%	0%	100%
Percentage Arrivals Day	11%	34%	0%	0%	0%	<1%	15%	1%	29%	1%	8%	<1%	100%
Percentage Arrivals Night	2%	29%	0%	0%	<1%	<1%	34%	<1%	13%	<1%	23%	<1%	100%

Source: Massport Noise Office and HMMH 2011.

Notes: The data reflect actual percentages of aircraft operations on each runway end. They should not be confused with effective runway use which is used by the Preferential Runway Advisory System (PRAS) to derive recommendations for use of a particular runway.
Runway 14-32 is unidirectional
Values may not add to 100 percent due to rounding.

Flight Tracks

RealContours™ converts each radar track to an INM model track and then models the scaled aircraft operation on that track. This method keeps the lateral and vertical dispersion of the aircraft types consistent with the radar data, and ensures that anomalies in the departure paths are captured in the RealContours™ system. Table H-4 lists the number of flight tracks used in the RealContours™ modeling system for 2011. Flight tracks from April of 2011 are displayed in Figures 6-6 through 6-11 in *Chapter 6, Noise Abatement*.

Table H-4 Total Count of Flight Tracks Modeled in RealContours™ (2011)

	Runway											
	4L	4R	9	14	15L	15R	22L	22R	27	32	33L	33R
Departures	6,268	9,704	57,776	18	45	8,877	3,321	63,838	11,553	0	15,080	0
Arrivals	16,496	59,110	0	0	3	485	29,934	711	47,106	1,843	17,923	252

Source: HMMH 2011, ITT NOMS data

Flight Profiles

To further enhance the results from RealContours™, Massport elected to use the companion RealProfiles™ software. By using the actual radar information along with the equations developed for the INM, RealProfiles™ develops an altitude profile for each aircraft operation. This profile is then modeled in the RealContours™ system. As a result, the modeled aircraft follows both the actual radar track on the ground and the actual radar altitude profile in the sky.

RealProfiles™ provides several advantages over the standard INM profile modeling. The standard INM modeling uses a "Stagelength" to identify an aircraft's departure weight and then models a standard departure profile for that Stagelength. Using Realprofiles™, the RealContours™ system selects a weight similar to the standard modeling but then develops a profile to allow the INM aircraft to follow the actual path flown for that route. For example, if aircraft departing from a particular runway are required to remain level at 3,000 feet for a certain distance, RealProfiles™ will develop a profile that remains level for that distance along the track. In contrast, the standard modeling would use the standard INM profile and would not model the level segment.

RealProfiles™ was able to compute profiles based on the actual radar data for 99.7 percent of the available departure tracks and 91.7 percent of the available arrivals. RealProfiles™ uses the INM supplied aircraft performance database to develop its unique profiles; however, for several aircraft in the INM database the aircraft performance data is not available. For those profiles the INM database contains fixed profiles which are not modified and are used as supplied with the INM data.

Residential Sound Insulation Program

In 2011, Massport completed sound insulation of 62 residential buildings containing 114 dwelling units, resulting in a total of 5,374 residential buildings and 11,333 dwelling units that have been sound-insulated since 1986 when the program was first implemented. Table H-5 lists the yearly progress of this mitigation effort.

Table H-5 Residential Sound Insulation Program Status (1986-2011)

Construction Year	Residential Buildings[1]	Dwelling Units[2]
1986	4	8
1987	43	51
1988	102	159
1989	94	133
1990	121	200
1991	175	360
1992	197	354
1993	318	654
1994	310	542
1995	372	753
1996	323	577
1997	364	808
1998	328	806
1999	330	718
2000	195	601
2001	260	278
2002	205	354
2003	230	468
2004	320	791
2005	314	471
2006	286	827
2007	160	548
2008	94	388
2009	111	287
2010	56	83
2011	62	114
Total	5,374	11,333

Source: Massport, 2011.
1 Includes multiple units.
2 Individual units.

Following the FAA's approval of model adjustments based on the effects of terrain (discussed in the *1999 ESPR*), Massport submitted, and the New England Region of the FAA approved, a new sound insulation program. The revised contour, approved for a two-year period beginning in 1999, included dwelling units in East Boston, South Boston, and Winthrop that previously had not been eligible for insulation. Massport received notice of FAA funding in the amount of $5 million. Subsequently, Massport updated its program contour, first with the *2001 EDR* contour and more recently with the Logan Airside Improvements Project approved contour. These updates have allowed Massport to continue the program with additional funds every

year since 1999. This latest update takes into account runway use changes due to the new Runway 14-32, which opened in late November 2006. This update expands the focus of the sound insulation program into Chelsea to satisfy the mitigation commitments made in the Airside Improvements Program Record of Decision. Massport has also utilized a program where they have contacted properties that are still eligible within the RSIP boundaries that had previously declined to participate. They have been offered a second chance to participate in the program.

Table H-6 provides a list of all schools that have been treated under Massport's sound insulation program. To date, Massport has provided sound insulation to 36 schools at a cost of over 8 million dollars.

Table H-6 Schools Treated Under Massport Sound Insulation Program

Boston:		
East Boston		
	East Boston High	$381,948
	St. Mary's Star of the Sea	$80,901
	St. Dominic Savio High	$127,879
	St. Lazarus	$46,092
	James Otis	$46,092
	Samuel Adams	$120,650
	Curtis Guild	$180,572
	Dante Alighieri	$97,750
	P.J. Kennedy	$127,637
	Donald McKay	$231,754
	Hugh Roe O'Donnell	$113,564
	E Boston Central Catholic	$391,768
	Manassah Bradley	$237,500
13	East Boston Schools	$2,184,107
South Boston:		
	St. Augustine	$92,855
	Cardinal Cushing	$47,276
	Patrick Gavin	$217,077
	St. Bridgid's	$112,100
	Oliver Hazard Perry	$337,538
	Condon School	$294,481
6	South Boston Schools	$1,101,327
Roxbury & Dorchester:		
	Samuel Mason	$192,401
	Dearborn Middle	$248,238
	Ralph Waldo Emerson	$155,851
	Lewis Middle	$202,092
	Nathan Hale Elem.	$92,302
	Phillis Wheatley Elem.	$290,794
	Davis Ellis Elem.	$253,663
	Henry L. Higginson	$119,543
8	Roxbury & Dorchester Schools	$1,554,884
27	Total Boston Schools	$4,840,318
Winthrop		
	Winthrop Jr. High School	$63,756
	E. B. Newton	$184,674
	A. T. Cummings (Ctr.) School	$800,000
3	Total Winthrop Schools	$1,048,430
Revere		
	Beachmont School	$854,864
1	Total Revere School	$854,864
Chelsea		
	Shurtleff School	$292,207
	Williams School	$486,258
	St. Rose Elementary	$46,396
	St. Stanislaus	$66,298
	Chelsea High School	$524,249
5	Total Chelsea Schools	$1,415,408
36	Total Schools	$8,159,020

Source: Massport, 2011

Noise Exposed Population

Table H-7 presents the noise exposed population by community for 2011. This table includes population within the DNL 60-65 dB contours, although a DNL of 65 dB is the federally-defined noise criterion used as a guideline to identify when residential land use is considered incompatible with aircraft noise.

Table H-7 Noise-Exposed Population by Community

Year	Census Data	80+ dB DNL	75+ dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
BOSTON[2]							
1990	1980	0	0	1,778	28,970	30,748	NA
1992	1980	0	0	800	4,316	5,116	NA
1993	1980	0	0	264	2,820	3,084	NA
1994	1990	0	106	265	7,698	8,069	30,895
1995	1990	0	106	851	8,815	9,772	33,765
1996	1990	0	106	374	8,775	9,255	40,992
1997	1990	0	106	719	13,857	14,682	54,804
1998	1990	0	58	580	10,877	11,515	52,201
1999[3]	1990	0	58	364	11,632	12,054	45,948
2000[3]	1990	0	58	183	7,880	8,121	32,474
2000[3]	2000	0	0	234	9,014	9,248	35,785
2001[3]	2000	0	0	315	6,515	6,700	27,778
2002[3]	2000	0	0	132	2,625	2,757	23,225
2003[3]	2000	0	0	164	1,730	1,894	21,763
2004[3,4]	2000	0	65	192	4,142	4,399	24,473
2005[3,4]	2000	0	65	104	2,020	2,189	17,661
2006 [4]	2000	0	65	99	1,054	1,218	14,866
2007 (INMv7.0a) [4]	2000	0	0	169	4,094	4,263	21,446
2008 (INMv7.0b) [4]	2000	0	5	0	3,487	3,492	18,890
2009 (INMv7.0b) [4]	2000	0	5	67	937	1,009	12,284
2010 (INMv7.0b) [4]	2000	0	0	67	644	711	14,900
2010 (INMv7.0b) [4]	2010	0	0	0	689	689	17,646
2011 (INMc7.0b)[4]	2010	0	0	0	331	331	12,155
2011 (INMc7.0c)[4]	2010	0	0	0	331	331	11,600
CHELSEA							
1990	1980	0	0	0	4,813	4,813	NA
1992	1980	0	0	0	3,952	3,952	NA
1993	1980	0	0	0	0	0	NA
1994	1990	0	0	0	0	0	8,510
1995	1990	0	0	0	95	95	9,750
1996	1990	0	0	0	0	0	8,744
1997	1990	0	0	0	0	0	10,001
1998	1990	0	0	0	0	0	9,222
1999	1990	0	0	0	95	95	9,249
2000	1990	0	0	0	0	0	5,622
2000	2000	0	0	0	0	0	7,361
2001	2000	0	0	0	0	0	4,508
2002	2000	0	0	0	0	0	3,995
2003	2000	0	0	0	0	0	3,591
2004[4]	2000	0	0	0	0	0	7,756
2005[4]	2000	0	0	0	0	0	5,772
2006[4]	2000	0	0	0	0	0	2,477
2007 (INMv7.0a) [4]	2000	0	0	0	0	0	9,774
2008 (INMv7.0b) [4]	2000	0	0	0	0	0	7,793
2009 (INMv7.0b) [4]	2000	0	0	0	0	0	5,462
2010 (INMv7.0b) [4]	2000	0	0	0	0	0	4,880
2010 (INMv7.0b) [4]	2010	0	0	0	0	0	4,897
2011 (INMv7.0b)[4]	2010	0	0	0	0	0	0
2011 (INMv7.0c)[4]	2010	0	0	0	0	0	0

Table H-7 Noise-Exposed Population by Community (Continued)

Year	Census Data	80+ dB DNL	75-80 dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
EVERETT							
1990	1980	0	0	0	0	0	NA
1992	1980	0	0	0	0	0	NA
1993	1980	0	0	0	0	0	NA
1994	1990	0	0	0	0	0	0
1995	1990	0	0	0	0	0	0
1996	1990	0	0	0	0	0	0
1997	1990	0	0	0	0	0	0
1998	1990	0	0	0	0	0	0
1999[3]	1990	0	0	0	0	0	0
2000[3]	1990	0	0	0	0	0	0
2000[3]	2000	0	0	0	0	0	0
2001[3]	2000	0	0	0	0	0	0
2002[3]	2000	0	0	0	0	0	0
2003[3]	2000	0	0	0	0	0	0
2004[3,4]	2000	0	0	0	0	0	0
2005[3,4]	2000	0	0	0	0	0	0
2006[4]	2000	0	0	0	0	0	0
2007 (INMv7.0a) [4]	2000	0	0	0	0	0	0
2008 (INMv7.0b) [4]	2000	0	0	0	0	0	0
2009 (INMv7.0b) [4]	2000	0	0	0	0	0	0
2010 (INMv7.0b) [4]	2000	0	0	0	0	0	0
2010 (INMv7.0b) [4]	2010	0	0	0	0	0	0
2011 (INMc7.0b)[4]	2010	0	0	0	0	0	0
2011 (INMc7.0c)[4]	2010	0	0	0	0	0	0
MEDFORD							
1990	1980	0	0	0	0	0	NA
1992	1980	0	0	0	0	0	NA
1993	1980	0	0	0	0	0	NA
1994	1990	0	0	0	0	0	0
1995	1990	0	0	0	0	0	0
1996	1990	0	0	0	0	0	0
1997	1990	0	0	0	0	0	0
1998	1990	0	0	0	0	0	0
1999	1990	0	0	0	0	0	0
2000	1990	0	0	0	0	0	0
2000	2000	0	0	0	0	0	0
2001	2000	0	0	0	0	0	0
2002	2000	0	0	0	0	0	0
2003	2000	0	0	0	0	0	0
2004[4]	2000	0	0	0	0	0	0
2005[4]	2000	0	0	0	0	0	0
2006[4]	2000	0	0	0	0	0	0
2007 (INMv7.0a)[4]	2000	0	0	0	0	0	0
2008 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2009 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2010 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2010 (INMv7.0b)[4]	2010	0	0	0	0	0	0
2011 (INMv7.0b)[4]	2010	0	0	0	0	0	0
2011 (INMv7.0c)[4]	2010	0	0	0	0	0	0

Table H-7 Noise-Exposed Population by Community (Continued)

Year	Census Data	80+ dB DNL	75-80 dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
QUINCY							
1990	1980	0	0	0	0	0	NA
1992	1980	0	0	0	0	0	NA
1993	1980	0	0	0	0	0	NA
1994	1990	0	0	0	0	0	0
1995	1990	0	0	0	0	0	0
1996	1990	0	0	0	0	0	0
1997	1990	0	0	0	0	0	0
1998	1990	0	0	0	0	0	0
1999	1990	0	0	0	0	0	0
2000	1990	0	0	0	0	0	0
2000	2000	0	0	0	0	0	636
2001	2000	0	0	0	0	0	610
2002	2000	0	0	0	0	0	610
2003	2000	0	0	0	0	0	610
2004[4]	2000	0	0	0	0	0	610
2005[4]	2000	0	0	0	0	0	610
2006[4]	2000	0	0	0	0	0	610
2007 (INMv7.0a)[4]	2000	0	0	0	0	0	0
2008 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2009 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2010 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2010 (INMv7.0b)[4]	2010	0	0	0	0	0	0
2011 (INMv7.0b)[4]	2010	0	0	0	0	0	0
2011 (INMv7.0c)[4]	2010	0	0	0	0	0	0
REVERE							
1990	1980	0	0	0	4,274	4,274	NA
1992	1980	0	0	0	3,848	3,848	NA
1993	1980	0	0	0	4,617	4,617	NA
1994	1990	0	0	0	3,569	3,569	2,099
1995	1990	0	0	0	3,364	3,364	2,304
1996	1990	0	0	172	3,292	3,464	2,505
1997	1990	0	0	0	3,293	3,293	2,047
1998	1990	0	0	0	3,168	3,168	2,132
1999	1990	0	0	128	3,165	3,293	2,047
2000	1990	0	0	0	2,552	2,552	2,386
2000	2000	0	0	0	2,496	2,496	3,100
2001	2000	0	0	0	2,496	2,496	3,100
2002	2000	0	0	0	2,822	2,822	2,399
2003	2000	0	0	0	2,994	2,994	2,227
2004[4]	2000	0	0	82	2,969	3,051	2,678
2005[4]	2000	0	0	82	2,540	2,622	2,731
2006[4]	2000	0	0	82	2,540	2,622	2,698
2007 (INMv7.0a)[4]	2000	0	0	0	2,450	2,450	2,853
2008 (INMv7.0b)[4]	2000	0	0	0	2,434	2,434	1,802
2009 (INMv7.0b)[4]	2000	0	0	0	2,512	2,512	1,452
2010 (INMv7.0b)[4]	2000	0	0	0	2,505	2,505	1,385
2010 (INMv7.0b)[4]	2010	0	0	0	2,413	2,413	2,473
2011 (INMv7.0b)[4]	2010	0	0	0	2,547	2,547	2,749
2011 (INMv7.0c)[4]	2010	0	0	0	2,547	2,547	3,123

Table H-7 Noise-Exposed Population by Community (Continued)

Year	Census Data	80+ dB DNL	75-80 dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
WINTHROP							
1990	1980	0	676	1,211	2,420	4,307	NA
1992	1980	0	626	1,146	2,488	4,262	NA
1993	1980	0	648	1,211	1,773	3,632	NA
1994	1990	0	417	1,343	5,154	6,914	7,512
1995	1990	0	482	1,611	5,757	7,850	7,077
1996	1990	0	417	1,376	5,930	7,723	7,333
1997	1990	0	417	1,659	6,386	8,462	6,839
1998	1990	0	519	1,522	6,572	8,613	6,507
1999	1990	0	353	1,408	5,946	7,707	7,135
2000	1990	0	277	991	5,240	6,508	7,296
2000	2000	0	247	1,070	4,684	6,001	7,776
2001	2000	0	244	683	4,123	5,050	8,104
2002	2000	0	2	481	2,247	2,730	7,921
2003	2000	0	0	339	1,956	2,295	7,386
2004[4]	2000	0	2	337	1,649	1,988	6,508
2005[4]	2000	0	39	347	1,280	1,666	6,353
2006[4]	2000	0	39	416	1,288	1,743	6,845
2007 (INMv7.0a)[4]	2000	0	0	247	1,139	1,386	6,749
2008 (INMv7.0b)[4]	2000	0	0	244	1,409	1,653	6,547
2009 (INMv7.0b)[4]	2000	0	0	171	643	814	4,221
2010 (INMv7.0b)[4]	2000	0	0	131	523	654	3,960
2010 (INMv7.0b)[4]	2010	0	0	130	598	728	3,720
2011 (INMv7.0b)[4]	2010	0	0	130	939	1069	4,373
2011 (INMv7.0c)[4]	2010	0	0	130	939	1069	4,303
All Communities							
1990	1980	0	676	2,989	40,477	44,142	NA
1992	1980	0	628	2,352	14,604	17,584	NA
1993	1980	0	648	1,475	9,210	11,333	NA
1994	1990	0	523	1,608	16,421	18,552	49,016
1995	1990	0	588	2,462	18,031	21,081	52,896
1996	1990	0	523	1,922	17,997	20,442	59,574
1997	1990	0	523	2,378	23,536	26,437	73,691
1998	1990	0	577	2,102	20,617	23,296	70,062
1999	1990	0	411	1,900	20,838	23,149	64,379
2000	1990	0	335	1,174	15,672	17,181	47,778
2000	2000	0	247	1,304	16,194	17,745	54,190
2001	2000	0	244	998	13,004	14,246	43,616
2002	2000	0	2	613	7,694	8,309	38,150
2003	2000	0	0	503	6,680	7,183	35,577
2004[4]	2000	0	67	611	8,760	9,438	41,975
2005[4]	2000	0	104	533	5,840	6,477	33,127
2006[4]	2000	0	104	597	4,882	5,583	27,496
2007 (INMv7.0a)[4]	2000	0	0	416	7,683	8,099	40,822
2008(INMv7.0b)[4]	2000	0	5	244	7,330	7,579	35,122
2009 (INMv7.0b)[4]	2000	0	5	238	4,092	4,335	23,419
2010 (INMv7.0b)[4]	2000	0	0	198	3,672	3,870	25,125
2010 (INMv7.0b)[4]	2010	0	0	130	3,700	3,830	28,736
2011 (INMv7.0b)[4]	2010	0	0	130	3,817	3,947	19,277
2011 (INMv7.0c)[4]	2010	0	0	130	3,817	3,947	19,026

Source: Data prepared for Massport by HMMH 2011.
Note: South End is included in Boston totals.
NA Not available.
1 65 dB DNL is the Federally-defined noise criterion.
2 Portions of Dorchester, East Boston, Roxbury, South Boston, and the
3 Boston population by community changed in 1999 due to employment of more accurate hill effects methodology and reporting change.
4 All results since 2004 are from the RealContours™ modeling system.

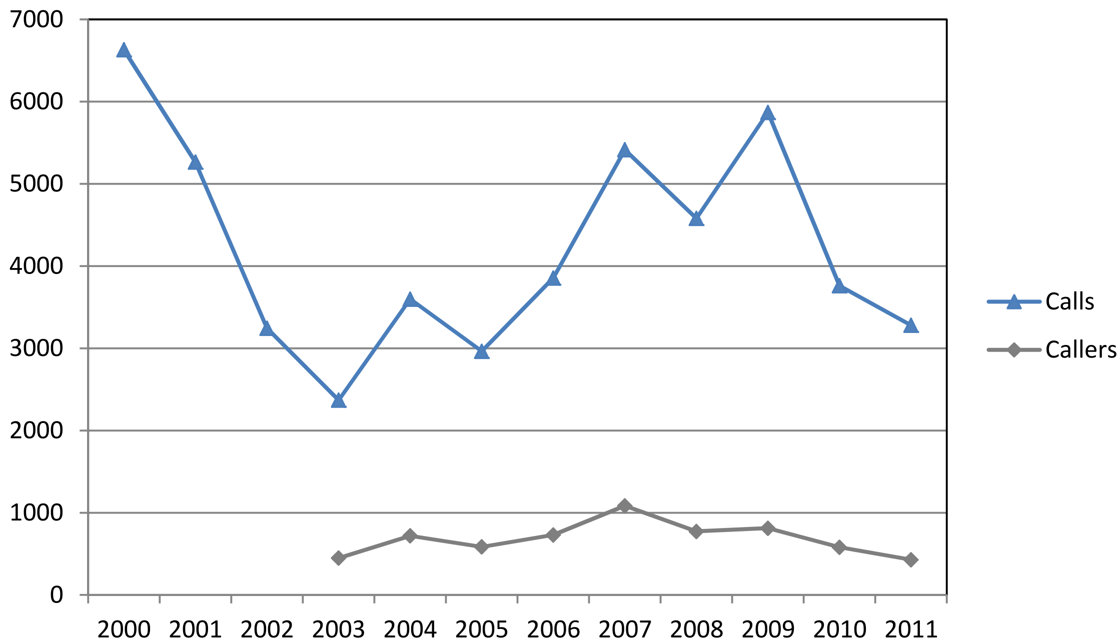
Noise Complaints

Table H-8 presents a summary by community of the total complaints made in 2011, which can be filed either by Massport's Noise Complaint Line or through a form on Massport's website. The Noise Complaint Line provides individuals the ability to express their concerns about aviation noise (activities) or to ask questions regarding noise at Logan Airport. Callers ask a range of questions such as "Why is this runway in use?", "What times do the planes stop flying?", and "Was that aircraft off-course?"

The Noise Abatement Office (NAO) staff documents noise line complaints by obtaining information from the caller about the nature of the complaint, time of the occurrence, location of caller's residence, and the activity that was disturbed. The NAO uses the collected information to determine the probable activity responsible for the complaint and writes a letter report to the complainant. The letter includes the original complaint, a response that identifies the activity responsible for the call (arrivals, departures, run-up, etc.), meteorological information at the time of the call (a major factor in aviation activities), runways in use at the time of the call, and a notice that the FAA will receive a copy of the report.

In 2011, Massport received a total of 3,280 noise complaints from 54 communities, a decrease of 12.8 percent from 2010, when the NAO received 3,761 complaints (Figure H-13). Four communities with more than 100 annual complaints had an increase in the number of calls from 2010 and three communities with more than 100 annual complaints had a decrease in the number of calls from 2010. Four communities had more than 100 complaints from an individual caller in 2011, a decrease from five communities in 2010. As shown in Figure H-13, there are fewer callers in 2011 than there have been since 2003, when the number of callers was first reported. Massport's website, www.massport.com, provides for additional general questions and answers regarding the Noise Complaint Line. The number of complaints received in 2011 is approximately half the number received in 2000 dropping from 6,631 (the highest in the past twelve years) to 3,280 calls in 2011.

Figure H-13 Number of Callers and Complaints between 2000 and 2011



Source: Massport, HMMH 2011.
Notes: Number of callers is not available before 2003.

Table H-8 Noise Complaint Line Summary

Town	2010 Calls	2010 Callers	2011 Calls	2011 Callers	Change Calls	Town	2010 Calls	2010 Callers	2011 Calls	2011 Callers	Change Calls
Amesbury	0	0	2	1	2	Marlborough	0	0	2	1	2
Andover	0	0	1	1	1	Marshfield	13	1	21	6	8
Arlington	11	7	0	0	(11)	Medford	444	53	297	13	(147)
Belmont	6	4	0	0	(6)	Medway	0	0	1	1	1
Beverly	2	2	0	0	(2)	Middleton	2	1	0	0	(2)
Boston	30	19	37	22	7	Milton	84	13	177	27	93
Braintree	1	1	3	3	2	Nahant	204	48	74	26	(130)
Brighton	3	3	0	0	(3)	Needham	1	1	0	0	(1)
Brockton	0	0	1	1	1	Newton	19	3	0	0	(19)
Brookline	2	1	0	0	(2)	Newtown	1	1	0	0	(1)
Burlington	3	2	0	0	(3)	North Easton	1	1	0	0	(1)
Cambridge	323	37	154	10	(169)	Norwell	13	1	1	1	(12)
Canton	1	1	2	2	1	Peabody	3	2	3	2	0
Charlestown	8	6	4	4	(4)	Quincy	8	5	12	9	4
Chelsea	129	17	27	9	(102)	Randolph	1	1	1	1	0
Cohasset	0	0	5	4	5	Reading	1	1	0	0	(1)
Danvers	0	0	1	1	1	Revere	92	27	66	20	(26)
Dedham	0	0	3	2	3	Roslindale	73	5	3	2	(68)
Dorchester	5	4	6	5	1	Roxbury	86	6	81	3	(5)
Duxbury	0	0	1	1	1	Salem	10	2	12	1	2
East Boston	699	51	116	34	(583)	Scituate	2	1	0	0	(2)
Easton	0	0	1	1	1	Somerville	385	74	98	45	(287)
Everett	40	15	19	4	(21)	South Boston	59	26	53	24	(6)
Framingham	3	1	1	1	(2)	South End	28	6	16	6	(12)
Hanover	0	0	1	1	1	South Hamilton	1	1	0	0	(1)
Hingham	24	7	19	3	(5)	Stoughton	5	1	3	2	(2)
Holland	0	0	2	1	2	Swampscott	0	0	5	4	5
Hull	15	11	5	3	(10)	Watertown	5	4	16	2	11
Hyde Park	2	1	3	1	1	West Roxbury	1	1	1	1	0
Jamaica Plain	158	15	63	6	(95)	Weymouth	193	4	228	7	35
Lynn	339	3	469	2	130	Wilmington	0	0	1	1	1
Malden	4	4	1	1	(3)	Winchester	8	5	2	1	(6)
Mansfield	0	0	3	2	3	Winthrop	207	70	1,147	92	940
Marblehead	1	1	8	4	7	Woburn	2	2	1	1	(1)
						Total	3,761	580	3,280	429	(1,325)

Source: Massport, HMMH 2011.

Fleet Mix

As in the past, operations by aircraft types have been summarized into several key categories: commercial (passenger and cargo) operations, Stage 2 or Stage 3 jet aircraft, and turboprop and propeller (non-jet) aircraft. In addition, the operations are split into daytime and nighttime periods, where nighttime hours are defined as 10:00 PM to 7:00 AM, consistent with the definition of DNL. Table H-9 summarizes the numbers of operations by categories of aircraft operating at Logan Airport from 1990 through 2011. General aviation (GA) operations were not included in the noise modeling prior to 1998 and commercial jet operations were not separated until 1999.

Table H-9 Modeled Daily Operations by Commercial and General Aviation Aircraft[1] – 1990 to 2011

		1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Commercial Aircraft													
Stage 2 Jets[2]	Day	312.40	228.89	203.34	189.40	156.90	132.40	108.46	84.93	83.30	5.13	1.18	0.05
	Night	19.99	13.13	7.44	10.10	5.50	4.79	7.75	5.92	6.66	0.26	0.05	0.00
	Totals	332.39	242.02	210.78	199.50	162.40	137.19	116.21	90.85	89.96	5.39	1.23	0.05
Stage 3 Jets (All)	Day	288.89	384.49	418.99	425.70	429.40	439.81	505.08	541.43	597.28	727.09	756.24	740.75
	Night	57.25	58.29	65.47	62.80	69.00	80.16	85.06	95.54	98.59	103.66	109.77	97.04
	Totals	346.14	442.78	484.46	488.50	498.40	519.97	590.14	636.97	695.87	830.75	866.01	837.79
Air Carrier Jets	Day	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	569.18	648.95	569.99	500.70
	Night	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	96.21	99.79	101.30	83.52
	Totals	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	665.39	748.74	671.29	584.22
Regional Jets	Day	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	28.10	78.14	186.25	240.05
	Night	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	2.38	3.87	8.47	13.52
	Totals	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	30.48	82.01	194.72	253.57
Non-Jet Aircraft	Day	444.41	411.84	598.16	541.97	526.85	505.31	514.70	552.56	448.82	409.62	317.62	165.45
	Night	11.72	69.32	46.84	13.59	11.14	13.73	27.27	21.86	16.63	21.58	10.97	3.45
	Total	456.13	481.16	645.00	555.56	537.99	519.04	541.97	574.42	465.45	431.20	328.58	168.89
Total Commercial Operations	Day	1045.70	1025.22	1220.49	1157.07	1113.15	1077.52	1128.24	1178.92	1129.90	1141.84	1075.04	906.25
	Night	88.96	140.74	119.75	86.49	85.64	98.68	120.08	123.32	121.88	125.51	120.79	100.49
	Total	1134.66	1165.96	1340.24	1243.56	1198.79	1176.20	1248.32	1302.24	1251.78	1267.35	1195.82	1006.73
GA Aircraft													
Stage 2 Jets[2]	Day	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	5.25	9.89	7.29	5.15	3.65
	Night	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	0.40	0.74	0.64	0.50	0.41
	Total	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	5.65	10.63	7.93	5.65	4.08
Stage 3 Jets	Day	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	30.54	48.46	40.08	34.23	37.83
	Night	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	4.21	6.55	3.21	3.28	6.42
	Total	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	34.75	55.01	43.29	37.51	44.25
Non-Jets	Day	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	37.29	19.36	34.57	37.31	17.36
	Night	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	16.28	18.89	1.83	1.92	4.45
	Total	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	53.57	38.25	36.40	39.23	21.81
Total GA Operations	Day	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	73.08	77.71	81.94	76.68	58.84
	Night	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	20.89	26.17	5.68	5.71	11.29
	Total	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	93.97	103.88	87.62	82.39	70.13
Total	Day	1045.70	1025.22	1220.49	1157.07	1113.15	1077.52	1128.24	1252.00	1207.61	1223.78	1151.72	965.09
	Night	88.96	140.74	119.75	86.49	85.64	98.68	120.08	144.21	148.05	131.19	126.50	111.78
	Total[3]	1134.66	1165.96	1340.24	1243.56	1198.79	1176.20	1248.32	1396.21	1355.66	1354.97	1278.21	1076.86

Table H-9 Modeled Daily Operations by Commercial and General Aviation Aircraft[1] – 1990 to 2011 (Continued)

		2003	2004	2005	2006	2007	2008	2009	2010	2011
Commercial Aircraft										
Stage 2 Jets[2]	Day	0.08	0.03	0.05	0.03	0.03	0.01	0.00	0.01	0.01
	Night	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.00
	Total	0.08	0.05	0.06	0.03	0.04	0.02	0.00	0.02	0.01
Stage 3 Jets (All)	Day	717.85	772.39	765.76	767.55	748.13	699.39	668..32	674.25	684.19
	Night	92.69	113.24	113.66	114.81	118.29	114.30	103.11	107.92	109.38
	Total	810.54	885.63	879.42	882.36	866.42	813.69	771.43	782.17	793.57
Air Carrier Jets[5]	Day	461.06	518.96	505.48	490.63	472.39	443.15	421.51	521.64	571.03
	Night	72.69	89.24	91.99	92.71	96.28	89.89	82.19	93.98	99.17
	Total	533.75	608.20	597.47	583.34	568.66	533.04	503.70	615.62	670.20
Regional Jets[5]	Day	256.80	253.43	260.34	276.95	275.77	256.24	246.81	152.61	113.16
	Night	19.99	24.00	21.68	22.11	22.03	24.40	20.93	13.94	10.21
	Total	276.79	277.43	282.01	299.06	297.80	280.64	267.73	166.55	123.37
Non-Jet Aircraft	Day	135.18	133.24	148.77	140.81	145.27	132.52	136.45	138.53	135.18
	Night	2.41	3.03	3.02	3.26	3.47	4.00	5.54	5.21	4.73
	Total	137.59	136.28	151.79	144.07	148.73	136.52	141.99	143.74	139.91
Total Commercial Operations	Day	853.10	905.66	914.59	908.41	893.43	831.92	804.77	812.78	819.39
	Night	95.10	116.29	116.68	118.09	121.77	118.31	108.65	113.13	114.11
	Total	948.20	1021.95	1031.27	1026.51	1015.19	950.23	913.42	925.91	933.50
GA Aircraft										
Stage 2 Jets[2]	Day	2.84	0.94	2.29	1.90	1.24	0.36	0.09	0.27	0.08
	Night	0.26	0.14	0.25	0.17	0.19	0.03	0.01	0.04	0.00
	Total	3.10	1.08	2.54	2.07	1.43	0.38	0.10	0.30	0.08
Stage 3 Jets	Day	46.21	53.72	58.84	61.08	54.82	43.98	22.31	27.80	52.51
	Night	6.98	8.37	9.33	6.57	6.39	4.52	2.28	3.21	5.35
	Total	53.19	62.09	68.16	67.65	61.21	48.49	23.59	31.01	57.87
Non-Jets	Day	17.81	16.95	14.00	15.05	11.98	15.13	8.19	8.19	18.18
	Night	4.40	5.20	4.75	1.39	3.61	1.08	0.74	0.72	1.29
	Total	22.21	22.14	18.75	16.44	15.58	16.20	8.93	8.92	19.48
Total GA Operations	Day	66.88	71.60	75.12	78.03	68.04	59.46	29.58	36.26	70.78
	Night	11.64	13.71	14.33	8.13	10.19	5.62	3.04	3.97	6.65
	Total	78.52	85.31	89.46	86.15	78.22	65.05	32.62	40.22	77.43
Total	Day	919.98	977.27	989.71	986.43	961.46	891.39	834.35	849.03	890.16
	Night	106.74	130.00	131.02	126.22	131.96	123.93	111.69	117.10	120.76
	Total[3]	1026.72	1107.26	1120.73	1112.66	1093.42	1015.31	946.04	966.13	1010.92

Source: Massport's Noise Monitoring System and Revenue Office numbers, HMMH 2011.
Note: Data from 1991 not available.
GA General Aviation
1 Includes scheduled and unscheduled operations.
2 Stage 2 aircraft are exempt from meeting newer federal Stage 3 noise limits when their maximum gross takeoff weight is less than or equal to 75,000 pounds.
3 Regional Jet operations were not tracked separately prior to 1999.
4 Totals prior to 1998 do not include GA operations.
5 The definition of regional jet for the EDR changed between 2009 and 2010. A regional jet in 2010 is a jet in commercial service with less than 80 seats, prior to 2010, a regional jet was a jet in commercial service with 100 seats or less.

Commercial Jet Aircraft by Part 36 Stage Category

Jet aircraft currently operating at Logan Airport are categorized by the FAA into two groups: Stage 2 and Stage 3. As described in *Chapter 6, Noise Abatement*, the designation refers to a noise classification specified in Federal Aviation Regulation (FAR) Part 36 that sets noise emission standards at three measurement locations – takeoff, landing, and sideline – based on an aircraft's maximum certificated weight. The heavier the aircraft, the more noise it is permitted to make within limits. Because of the substantial differences in noise between Stage 2, recertificated Stage 3, and new Stage 3 aircraft, Massport tracks operations by these separate categories to follow their trends. Table H-10 shows the percentage of commercial jet operations by stage category from 1999 through 2011. One of the most significant changes occurring after the economic downturn in 2001 was the almost immediate retirement of the recertificated aircraft from airlines' fleets due to their high operating costs. This type of accelerated retirement is not as prevalent during the 2008 to 2009 economic downturn since it is no longer the major airlines that are operating these aircraft. However, these aircraft still suffer from high operating costs and are being replaced wherever possible.

Table H-10 Percentage of Commercial Jet Operations by Part 36 Stage Category – 1999 to 2011

	New Stage 3[1]	Recertificated Stage 3[2]	Stage 2	Total
1999	70.0%	21.0%	9.0%	100%
2000	75.0%	24.0%	1.0%	100%
2001	86.3%	13.6%	0.1%	100%
2002	92.8%	7.2%	0.0%	100%
2003	95.8%	4.1%	0.0%	100%
2004	97.8%	2.2%	0.0%	100%
2005	98.0%	2.0%	0.0%	100%
2006	98.6%	1.4%	0.0%	100%
2007	98.9%	1.1%	0.0%	100%
2008	99.1%	0.9%	0.0%	100%
2009	99.1%	0..9%	0.0%	100%
2010	98.9%	1.1%	0.0%	100%
2011	99.5%	0.5%	0.0%	100%

Source: Massport and FAA radar data.

1 New Stage 3 aircraft are aircraft originally manufactured as a certified Stage 3 aircraft under Federal Regulation Part 36.

2 Recertificated Stage 3 aircrafts are aircrafts originally manufactured as a certified Stage 1 or 2 aircrafts under Federal Regulation Part 36 which have been either treated with hushkits or have been re-engineered to meet Stage 3 requirements.

Nighttime Operations

Massport tracks flights that operate between the broader DNL nighttime periods of 10:00 PM to 7:00 AM, when each flight is penalized 10 dB in calculations of noise exposure. Table H-11 shows this nighttime activity by different groups of aircraft. Nighttime flights by commercial jet operators have increased 1.3 percent at Logan Airport compared to 2010. Commercial non-jet operations decreased 0.5 percent from 2010 and GA traffic is up 67.5 percent at night. Overall, nighttime operations at Logan Airport increased 3.1 percent. The majority of nighttime operations (between 10:00 PM and 7:00 AM) occurred either before midnight or after 5:00 AM.

Table H-11 Modeled Nighttime Operations at Logan Airport – 1990 to 2011

	Commercial Jets	Commercial Non-Jets	General Aviation[1]	Total
1990	77.24	11.72	NA	88.96
1991	NA[2]	NA[2]	NA[2]	NA[2]
1992	71.42	69.32	NA	140.74
1993	72.91	46.84	NA	119.75
1994	72.90	13.59	NA	86.49
1995	74.50	11.14	NA	85.64
1996	84.95	13.73	NA	98.68
1997	92.81	27.27	NA	120.08
1998	101.46	21.86	NA	123.32
1999	105.25	16.63	26.17	148.05
2000	103.92	21.58	5.68	131.19
2001	109.82	10.97	5.71	126.50
2002	97.04	3.45	11.29	111.78
2003	92.69	2.41	11.64	106.74
2004	113.26	3.03	13.71	130.00
2005	113.67	3.02	14.33	131.02
2006	114.81	3.26	8.13	126.22
2007	118.30	3.47	10.19	131.96
2008	114.31	4.00	5.62	123.93
2009	103.05	5.56	3.08	111.70
2010	107.93	5.21	3.97	117.10
2011	109.38	4.73	6.65	120.76
Change (2010 to 2011)	1.45	(0.48)	2.68	3.66
Percent Change	1.3%	(9.2%)	67.5%	3.1%

Source: Massport, HMMH, 2011.
1 General aviation data not available prior to 1999.
2 1991 data not available.

Jet Runway Use

Table H-12 presents a summary of runway use by jets. Since 2001, the radar data have been analyzed with Massport's PreFlight™ software. PreFlight™ is an analysis package used to compile fleet, day/night splits, and runway use information from radar data. Data prior to 2001 were derived from Massport's original noise monitoring system, supplemented with field records. Note that Logan Airport Noise Rules prevent arrivals to Runway 22R and departures from Runway 4L by jet aircraft.

Table H-12 Summary of Jet Aircraft Runway Use – 1990 to 2000

	Runway									
	4L	4R	9	14[1]	15R	22L	22R	27	32[1]	33L
1990										
Departures	0%[2]	3%	21%	NA	10%	2%	36%	20%	NA	7%
Arrivals	1%	25%	0%	NA	2%	14%	0%	28%	NA	29%
1992[2]										
Departures	0%	6%	31%	NA	7%	2%	38%	10%	NA	6%
Arrivals	1%	37%	0%	NA	3%	12%	0%	30%	NA	17%
1993										
Departures	0%	9%	33%	NA	7%	3%	40%	4%	NA	4%
Arrivals	2%	44%	0%	NA	1%	11%	0%	28%	NA	15%
1994										
Departures	0%	9%	33%	NA	4%	3%	32%	12%	NA	5%
Arrivals	3%	42%	0%	NA	1%	8%	0%	27%	NA	19%
1995										
Departures	0%	8%	36%	NA	5%	5%	29%	11%	NA	5%
Arrivals	3%	41%	0%	NA	2%	8%	0%	27%	NA	17%
1996										
Departures	0%	8%	32%	NA	5%	6%	33%	12%	NA	5%
Arrivals	2%	38%	0%	NA	2%	11%	0%	29%	NA	18%
1997										
Departures	0%	8%	30%	NA	5%	6%	31%	15%	NA	5%
Arrivals	2%	36%	0%	NA	2%	9%	0%	30%	NA	20%
1998										
Departures	0%	8%	35%	NA	6%	5%	28%	14%	NA	5%
Arrivals	2%	41%	0%	NA	2%	7%	0%	28%	NA	19%
1999										
Departures	0%	8%	31%	NA	5%	4%	30%	15%	NA	6%
Arrivals	3%	37%	0%	NA	2%	10%	0%	28%	NA	21%
2000										
Departures	0%	8%	35%	NA	4%	3%	30%	15%	NA	6%
Arrivals	4%	50%	0%	NA	1%	7%	0%	28%	NA	20%

Table H-12 Summary of Jet Aircraft Runway Use – 2001 to 2011 (Continued)

	Runway									
	4L	4R	9	14[1]	15R	22L	22R	27	32[1]	33L
2001										
Departures	0%	7%	34%	NA	4%	3%	35%	12%	NA	5%
Arrivals	5%	36%	0%	NA	1%	8%	0%	32%	NA	18%
2002										
Departures	0%	4%	31%	NA	6%	3%	35%	16%	NA	6%
Arrivals	6%	31%	0%	NA	1%	12%	0%	30%	NA	21%
2003										
Departures	0%	4%	33%	NA	7%	2%	34%	14%	NA	6%
Arrivals	7%	33%	0%	NA	1%	14%	0%	28%	NA	18%
2004										
Departures	0%	5%	34%	NA	10%	4%	24%	18%	NA	6%
Arrivals	6%	34%	0%	NA	1%	12%	0%	24%	NA	23%
2005										
Departures	0%	5%	36%	NA	7%	1%	31%	13%	NA	7%
Arrivals	8%	33%	0%	NA	1%	11%	0%	29%	NA	17%
2006										
Departures	0%	4%	33%	0%	3%	1%	40%	13%	-	6%
Arrivals	7%	29%	0%	-	1%	14%	0%	33%	0.2%	16%
2007										
Departures	0%	5%	31%	0%	4%	1%	33%	7%	-	19%
Arrivals	5%	31%	0%	-	1%	15%	0%	36%	2%	11%
2008										
Departures	0%	6%	33%	<1%	3%	<1%	36%	6%	-	16%
Arrivals	6%	30%	-	-	2%	17%	-	33%	2%	11%
2009										
Departures	0%	7%	32%[3]	0%	3%	2%	34%	6%[3]	-	16%
Arrivals	7%	31%	-	-	3%	17%	0%	30%[3]	1%	11%
2010										
Departures	0%	4%	28%	<1%	8%	2%	31%	10%	-	17%
Arrivals	5%	28%	-	-	1%	15%	0%	32%	1%	16%
2011										
Departures	0%	6%	36%	<1%	5%[4]	2%	36%	7%	-	7%[4]
Arrivals	7%	37%	-	-	<1%[4]	16%	0%	28%	1%	11%[4]

Source: HMMH 2011, Massport Noise Office.

Notes: The data reflect actual percentages of jet aircraft operations on each runway end. They should not be confused with effective runway use which is used by the PRAS to derive recommendations for use of a particular runway. Effective runway percentages include a factor of 10 applied to nighttime operations so that use of a runway at night more closely reflects its effect on total noise exposure.

Jet aircraft are not able to use Runway 15L or 33R due to its length of only 2,557 feet.

Values may not add to 100 percent due to rounding.

1 Runway 14-32 opened in late November, 2006. (Runway 14-32 is unidirectional with no arrivals to Runway 14 and no departures from Runway 32).

2 1991 data are not available. The *1990 Final Generic Environmental Impact Report* was published and submitted to the Secretary of Environmental Affairs in July 1993. It included modeled operations and resulting noise contours for 1987, 1990, and a 1996 forecast year. The *1993 Annual Update* published in July 1994 included operations and contours for 1992 and 1993. 1991 data are not available.

3 Runway 9-27 had extended weekend closings for resurfacing during 2009.

4 Runway 15R-33L was closed for 3 months in 2011.

NA Runway was not available.

Cumulative Noise Index (CNI)

Massport reports total annual fleet noise at Logan Airport, defined in the Logan Airport Noise Rules by a metric referred to as the Cumulative Noise Index (CNI). The CNI is a single number representing the sum of the entire set of single-event noise levels experienced at the Airport over a full year of operation, weighted similarly to DNL so that activity occurring at night is penalized by adding an extra 10 dB to each event. This penalty is mathematically equivalent to multiplying the number of nighttime events by each aircraft by a factor of 10. The Logan Airport Noise Rules define CNI in terms of Effective Perceived Noise Level (EPNL) and require that the index be computed for the fleet of commercial aircraft operating at Logan Airport throughout the year. In addition, in EDRs and ESPRs, Massport reports partial CNI values of noise at Logan Airport, so that various subsets of the fleet (cargo, night operations, passenger jets, etc.) are identified.

The Noise Rules, adopted by Massport following public hearings held in February 1986, established a CNI limit of 156.5 Effective Perceived Noise Decibels (EPNdB). The CNI generally has decreased since 1990, remaining below that cap, with changes from year to year on the order of a few tenths of a decibel. The 2011 CNI remains well below the cap of 156.5 EPNL.

Table H-13 Cumulative Noise Index (EPNL) – 1990 to 2002

	Logan Airport CNI Cap – 156.5 EPNL												
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Full CNI (Entire Commercial Jet Fleet)	156.4	155.8	155.5	155.3	155.4	155.3	155.1	154.8	154.7	154.9	154.7	154.1	153.2
Total Passenger Jets	155.2	154.8	154.6	154.4	154.4	154.2	154.1	153.9	153.7	153.9	153.6	152.9	151.8
Total Cargo Jets	150.1	148.9	148.0	147.9	148.3	148.8	148.6	147.5	147.9	148.0	148.2	147.8	147.4
Total Daytime	152.5	152.1	152.4	152.1	152.1	151.6	151.2	150.8	150.4	150.4	149.5	149.0	148.5
Total Nighttime	154.4	153.4	152.6	152.4	152.6	152.9	152.9	152.5	152.7	153.1	153.1	152.4	151.3
Total Stage 2 Jets	NA	NA	NA	NA	151.0	150.2	149.4	149.2	147.7	147.1	124.7	121.5	114.3
Total Stage 3 Jets	NA	NA	NA	NA	153.4	153.8	153.8	153.4	153.8	154.2	154.7	154.1	153.2
Daytime Stage 2	NA	NA	NA	NA	149.0	148.5	147.6	146.5	145.2	144.1	122.6	119.3	111.2
Nighttime Stage 2	NA	NA	NA	NA	146.7	145.1	144.8	145.8	144.1	144.0	120.5	117.3	111.4
Daytime Stage 3	NA	NA	NA	NA	149.1	148.8	148.7	148.8	148.9	149.2	149.5	149.0	148.5
Nighttime Stage 3	NA	NA	NA	NA	151.4	152.1	152.2	151.5	152.1	152.5	153.1	152.4	151.3
Passenger Jet Stage 2	NA	NA	NA	NA	150.5	149.9	149.2	148.9	147.5	146.8	124.2	116.3	NA
Passenger Jet Stage 3	NA	NA	NA	NA	152.2	152.3	152.3	152.2	152.6	153.0	153.6	152.9	151.8
Cargo Jet Stage 2	NA	NA	NA	NA	141.5	137.4	136.8	137.4	139.0	134.5	114.8	119.9	114.3
Cargo Jet Stage 3	NA	NA	NA	NA	147.3	148.5	148.3	147.0	147.3	147.9	148.2	147.8	147.4
Daytime Passenger	NA	152.0	152.2	152.0	152.0	151.5	151.1	150.6	150.1	150.1	149.3	148.7	148.2
Nighttime Passenger	NA	151.6	150.9	150.6	150.8	151.0	151.0	151.1	151.2	151.6	151.6	150.8	149.4
Daytime Cargo	137.1	137.1	137.6	135.2	136.1	138.0	136.7	136.2	138.0	138.2	137.5	137.1	137.0
Nighttime Cargo	149.9	148.6	147.6	147.6	148.0	148.4	148.3	147.1	147.5	147.6	147.8	147.4	147.0
Daytime Passenger Stage 2	NA	NA	NA	NA	148.9	148.4	147.6	146.5	145.0	143.9	122.3	115.0	NA
Daytime Passenger Stage 3	NA	NA	NA	NA	149.0	148.5	148.4	148.5	148.6	149.0	149.2	148.7	148.2
Nighttime Passenger Stage 2	NA	NA	NA	NA	149.0	148.5	148.4	148.5	142.8	143.7	119.8	110.2	NA
Nighttime Passenger Stage 3	NA	NA	NA	NA	149.4	149.9	150.1	149.8	150.5	150.8	151.6	150.8	149.4
Daytime Cargo Stage 2	NA	NA	NA	NA	128.3	126.7	124.6	126.4	131.6	131.5	111.1	117.3	111.2
Daytime Cargo Stage 3	NA	NA	NA	NA	135.3	137.7	136.4	135.7	136.9	137.1	137.5	137.0	137.0
Nighttime Cargo Stage 2	NA	NA	NA	NA	141.3	137.0	136.5	137.0	138.2	131.5	112.3	116.4	111.4
Nighttime Cargo Stage 3	NA	NA	NA	NA	147.0	148.1	148.0	146.6	146.9	147.5	147.8	147.4	147.0

Table H-13 Cumulative Noise Index (EPNL) – 2003 to 2011 (Continued)

	Logan Airport CNI Cap – 156.5 EPNL									
Full CNI (Entire Commercial Jet Fleet)	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change from 2010
	152.7	153.4	153.2	152.6	152.7	152.9	152.3	151.9	152.1	0.2
Total Passenger Jets	151.3	152.2	152.1	151.4	151.5	151.9	151.1	150.9	150.6	(0.3)
Total Cargo Jets	147.1	147.0	146.6	146.5	146.4	146.1	145.9	145.1	146.7	1.6
Total Daytime	148.0	148.5	148.2	147.5	147.2	147.6	147.1	146.8	146.9	0.1
Total Nighttime	150.9	151.7	151.6	151.0	151.2	151.4	150.7	150.3	150.6	0.3
Total Stage 2 Jets	114.1	118.1	NA	NA	NA	NA	NA	113.6	110.8	(2.8)
Total Stage 3 Jets	152.7	153.4	153.2	152.6	152.7	152.9	152.3	151.9	152.1	0.2
Daytime Stage 2	113.7	109.4	NA	NA	NA	NA	NA	103.6	NA	NA
Nighttime Stage 2	103.2	117.5	NA	NA	NA	NA	NA	113.1	110.8	(2.3)
Daytime Stage 3	148.0	148.5	148.2	147.5	147.2	147.6	147.1	146.8	146.9	0.1
Nighttime Stage 3	150.9	151.7	151.6	151.0	151.2	151.4	150.7	150.3	150.6	0.3
Passenger Jet Stage 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Passenger Jet Stage 3	151.3	152.2	152.1	151.4	151.5	151.9	151.1	150.9	150.6	(0.3)
Cargo Jet Stage 2	114.1	118.1	NA	NA	NA	NA	NA	113.6	110.8	(2.8)
Cargo Jet Stage 3	147.1	147.0	146.6	146.5	146.4	146.1	145.9	145.1	146.7	1.6
Daytime Passenger	147.7	148.2	147.9	147.2	146.9	147.3	146.8	146.6	146.5	(0.1)
Nighttime Passenger	148.8	150.0	150.1	149.3	149.7	150.0	149.1	149.0	148.5	(0.5)
Daytime Cargo	136.2	135.7	135.8	135.5	135.8	135.8	135.2	134.5	136.6	2.1
Nighttime Cargo	146.8	146.7	146.2	146.1	146.0	145.6	145.5	144.7	146.3	1.6
Daytime Passenger Stage 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Daytime Passenger Stage 3	147.7	148.2	147.9	147.2	146.9	147.3	146.8	146.6	146.5	(0.1)
Nighttime Passenger Stage 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nighttime Passenger Stage 3	148.8	150.0	150.1	149.3	149.7	150.0	149.1	149.0	148.5	(0.5)
Daytime Cargo Stage 2	113.7	109.4	NA	NA	NA	NA	NA	103.6	NA	NA
Daytime Cargo Stage 3	136.1	135.7	135.8	135.5	135.8	135.8	135.2	134.4	136.6	2.2
Nighttime Cargo Stage 2	103.2	117.5	NA	NA	NA	NA	NA	113.1	110.8	(2.3)
Nighttime Cargo Stage 3	146.8	146.7	146.2	146.1	146.0	145.6	145.5	144.7	146.3	1.6

Source: HMMH 2011
Notes: GA and non-jet aircraft are not included in the calculation.
NA - No operations by this aircraft type in the commercial fleet.
A few Stage 2 cargo Lear 25s were in this year's fleet.

Flight Track Monitoring Report

Introduction

As part of its ongoing commitment to mitigate noise at Logan Airport, Massport has undertaken evaluating the flight tracks of turbojet aircraft engaged in the implementation of established FAA noise abatement procedures. As is true for any airport operator, however, Massport has no authority to control where individual aircraft actually fly. That remains the responsibility of the FAA, while the individual pilots are responsible for safely executing the FAA's instructions. The flight procedures, which are used by the Air Traffic Control staff at Boston Tower to achieve desired noise abatement tracks, are contained in the FAA's Tower Order BOS TWR 7040.1.

This is the 10th annual report for flight track monitoring; prior to 2002 Massport had issued semi-annual reports, an outgrowth of the Flight Track Monitoring Program study. That study was contained in the *Generic Environmental Impact Report* filed with Massachusetts Environmental Policy Act (MEPA) in July of 1996, and was the subject of two Community Working Group (CWG) workshops in September and October of 1996. The time period covered by this *2011 ESPR* is January 1 through December 31, 2011.

The purpose of the ongoing monitoring program is to identify any systematic changes in flight tracks that may occur and to reduce flight track dispersion, where appropriate. The next report will cover the period January 1, 2012 through December 31, 2012, and will be included in the next EDR.

FAA Air Traffic Control Procedures

FAA Tower Order BOS TWR 7040.1 entitled "Noise Abatement" describes the series of noise abatement policies, rules, regulations, and the procedures to be followed by the FAA air traffic controllers in meeting their designated responsibilities to be "a good neighbor, while meeting our operational objectives/responsibilities to the National Airspace System (NAS)". Section 7.3 of the Order, subtitled "Turbojet Departure Noise Abatement Procedures" lists that all turbojet departures shall be issued the Standard Instrument Departure (SID) procedure appropriate for the departure runway. They are paraphrased from the Logan Six SID below.

Note in the descriptions that follow that terms such as "BOS 2 DME" are used frequently. Here, BOS refers to an aid to navigation known as the BOSTON VORTAC, a radio beacon physically located on the Airport near the eastern shoreline between the ends of Runways 27 and 33L. DME refers to "Distance Measuring Equipment", a co-located aid to navigation that provides pilots with a cockpit display of the number of nautical miles that the aircraft is from the designated radio beacon. Thus, BOS 2 DME means an aircraft should be two nautical miles away from the BOSTON VORTAC. The term "vectored" means the pilot is assigned to fly a magnetic heading given by and at the discretion of the FAA air traffic controller in order to maintain the safe separation of aircraft. "MSL" is defined as feet above mean sea level and is the indicator of aircraft altitude used both by the pilot in the cockpit and the air traffic controller on the ground.

During 2010, several of the conventional-only or radar vector procedures from the Boston Logan Airport Noise Study (BLANS) CATEX[6] were implemented. There are eight new Area Navigation (RNAV) procedures for departures from Logan Airport. These eight procedures are used by Runways 4R, 9, 15R, 22L and 22R. These procedures primarily affected departures flying over the North and South shores and were designed to increase the amount of jet traffic crossing back over land above 6,000 feet to minimize noise impacts to communities.

6 Federal Aviation Administration Categorical Exclusion Record of Decision, Issued October 16, 2007

- For departures, the noise abatement procedure in the Tower Order is:
  - For Runway 4R, fly heading 036 degrees until the BOS 4 DME, then turn right to a heading of 090 degrees, then expect radar vectors to assigned Route/Navaid/Fix. Aircraft that are vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
  - For Runway 9, the procedure is: Fly heading 093 degrees, then expect radar vectors to assigned Route/Navaid/Fix. Aircraft that are vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
  - For Runway 14, the procedure is: Fly heading 142 degrees until the BOS 1 DME, then turn left to heading 120 degrees, then expect radar vectors to assigned Route/Navaid/Fix. Aircraft that are vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
  - For Runway 15R, the procedure is: Fly heading 151 degrees until the BOS 1 DME then turn left to 120 degrees, then expect radar vectors to assigned Route/Navaid/Fix. Aircraft that are vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
  - For Runway 22R and 22L: Turn left to a heading of 140 degrees, then expect radar vectors to assigned Route/Navaid/Fix. Aircraft that are vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runway 33L: Fly heading 331 degrees until the BOS 2 DME then turn left to 316 degrees, then expect radar vectors to assigned Route/Navaid/Fix.
- For Runway 27:
  - LOGAN SIX SID: Fly heading 273 until the BOS 2.2 DME, then turn left heading 235 degrees then expect radar vectors to assigned Route/Navaid/Fix. Note that this procedure was replaced by the LOGAN FIVE effective November 18, 2010, but the initial Runway 27 departure described here did not change.
  - WYLLY ONE RNAV (for turbojet aircraft only). Climb heading 273 degrees to intercept course 235 degrees to cross WYLYY at 2300 or above. This procedure keeps most jet traffic in a well-defined flight corridor.

These brief procedural statements form the basis of the verbal instructions and flight clearances that are passed from controller to pilot in order to achieve reduced noise in the communities surrounding Logan Airport while also maintaining the safe and efficient flow of aircraft in and out of the Airport. However, consistency with which these procedures are used varies due to air traffic demands, controller workloads, weather conditions, and other operational factors, as noted in the Flight Track Monitoring Program Study.

Figure H-14 presents the gates used in the analysis for the Flight Track Monitoring Report. These gates are virtual vertical planes, which are used in the analysis to capture the Airport flight paths. The gates are defined using a geographic coordinate for each end of the gate along with a floor and a ceiling altitude. The gates also capture direction of flights (in or out). The edges of each gate in Figure H-14 point in the direction that the aircraft is coming from. This information is used to evaluate the performance of the flight procedures off each runway end and is presented below.

Figure H-14 Logan Airport Gates

Statistical Analyses of Flight Tracks - Runway 4R

The Nahant Gate (Figure H-14) monitors aircraft after the first turn at 4 DME. The Swampscott and Marblehead Gates monitor northbound shoreline crossings, while the Hull 2, Hull 3, and Cohasset Gates monitor southbound shoreline crossings.

Table H-14 shows the dispersion of the jet departures on Runway 4R as they pass through the Nahant Gate. Table H-14 shows that Runway 4R departures were concentrated, with 96.9 percent "over the Causeway", and about 0.1 percent over the south end of the gate compared to 88.87 percent over the Causeway in 2010 and 0.3 percent over the south end of the gate. Departures through the north end of the gate decreased from 11.0 percent in 2010 to 3.0 percent in 2011.

Table H-14 Runways 4R/4L Nahant Gate Summary for 2011

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
North End of Gate	261	8,749	3.0%
Over Causeway	8,475	8,749	96.9%
South End of Gate	13	8,749	0.1%
Total	8,749	8,749	100.0%

Source: Massport, HMMH 2011.

Table H-15 shows how many of the shoreline crossings from Runway 4R were above 6,000 feet. For 2011, 98.4 percent of the flights were above 6,000 feet compared to 97.0 percent in 2010. The Swampscott gate had 34.1 percent of flights above 6,000 feet compared to 40.0 percent in 2010. The number of flights through the Swampscott gate decreased in 2011 (80 in 2010, down to 41 in 2011). The crossing percentage for this gate is historically lower than most gates due to its proximity to the Nahant gate itself. As seen in Figure H-14, the Swampscott gate is adjacent to the Nahant gate and aircraft would have to climb very quickly in order to be above 6,000 feet when crossing the Swampscott gate.

Table H-15 Runways 4R/4L Shoreline Crossings Above 6,000 Feet for 2011

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Swampscott Gate	41	14	34.1%
Marblehead Gate	3,340	3,296	98.7%
Hull 2 Gate	414	414	100.0%
Hull 3 Gate	1,404	1,387	98.8%
Cohasset Gate	897	885	98.7%
Total	6,096	5,996	98.4%

Source: Massport, HMMH 2011.

Statistical Analyses of Flight Tracks - Runway 9

The Winthrop 1 and Winthrop 2 gates (Figure H-14) monitor early turns for departures off Runway 9. The Revere, Swampscott, or Marblehead gates monitor northbound shoreline crossings, while the Hull 2, Hull 3, or Cohasset gates monitor southbound shoreline crossings.

Table H-16 shows how many tracks turned prior to the BOS 2 DME. Northbound turns before BOS 2 DME pass through the Winthrop 1 Gate. Southbound traffic would pass through the Winthrop 2 Gate. In 2011, between both gates there were a total of 51 such turns, or about 0.1 percent. This is the same as in 2010 accept the number of tracks through each gate is slightly different.

Table H-16 Runway 9 Gate Summary — Winthrop Gates 1 and 2 for 2011

	Number of Departure Tracks	Number of Tracks Through Gate	Percent Turning Before BOS 2 DME
Winthrop 1 Gate	54,035	20	<0.1%
Winthrop 2 Gate	54,035	31	0.1%
Total	54,035	51	0.1%

Source: Massport, HMMH 2011.

Table H-17 indicates that 98.4 percent of Runway 9 departures were above 6,000 feet when crossing the shoreline, as compared with 97.3 percent in 2010. The number of Runway 9 departures crossing back over the South shore increased from 38,556 in 2010 to 51,014. A decrease in the percentage above 6,000 feet occurred at the Revere gate (84.5 percent in 2010 to 48.5 percent in 2011) and the Swampscott gate (90.2 percent in 2010 to 76.6 percent in 2011). The number of crossings declined for the Revere gate (58 in 2010 to 33 in 2011) and the Swampscott gate (235 in 2010 to 145 in 2011), which contributed to the decline in percentage above 6,000 feet. The Marblehead gate had an increase in crossings (from 9,897 in 2010 to 13,122 in 2011), and an increase in the percent above 6,000 feet (from 97.7 percent in 2010 to 98.6 percent in 2011). In percentage above 6,000 feet, Hull 2 gate increased from 98.5 in 2010 to 99.1 in 2011 and Hull 3 gate decreased from 95.0 in 2010 to 94.1 in 2011. The Cohasset gate increased significantly in crossings (from 21,444 in 2010 to 34,013 in 2011) and the percent above 6,000 feet increased from 97.7 percent in 2010 to 98.8 percent in 2011.

Table H-17 Runway 9 Shoreline Crossings Above 6,000 Feet for 2011

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Revere Gate	33	16	48.5%
Swampscott Gate	145	111	76.6%
Marblehead Gate	13,122	12,934	98.6%
Hull 2 Gate	881	873	99.1%
Hull 3 Gate	2,820	2,655	94.1%
Cohasset Gate	34,013	33,597	98.8%
Total	51,014	50,186	98.4%

Source: Massport, HMMH 2011.

Statistical Analyses of Flight Tracks - Runway 15R

After takeoff, Runway 15R departures turn left approximately 30 degrees to avoid Hull, head out over Boston Harbor, and return back over the shore through the Swampscott and Marblehead Gates (Figure H-14) to the north, or through the Hull 2, Hull 3, and Cohasset Gates to the south.

Table H-18 indicates that 99.4 percent of Runway 15R departures were above 6,000 feet when crossing the shoreline, as compared with 96.2 percent in 2010. At 96.3 percent, the percent above 6,000 feet for the Swampscott decreased in 2011 as it was 98.1 in 2010. The Marblehead gate had a decrease in crossings (from 2,180 in 2010 to 1,866 in 2011) and a slight increase in the percent above 6,000 feet (from 99.6 percent in 2010 to 99.8 percent in 2011). The Hull 2 gate decreased its percentage from 95.9 percent in 2010 to 95.7 percent in 2011, and the Hull 3 gate increased from 92.2 percent in 2010 to 92.8 percent in 2011). The Cohasset gate had an increase in crossings (from 3,050 in 2010 to 4,563 in 2011) and the percent above 6,000 feet increased from 97.6 percent to 99.6 percent.

Table H-18 Runway 15R Shoreline Crossings Above 6,000 Feet for 2011

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Swampscott Gate	54	52	96.3%
Marblehead Gate	1,866	1,863	99.8%
Hull 2 Gate	23	22	95.7%
Hull 3 Gate	236	219	92.8%
Cohasset Gate	4,563	4,545	99.6%
Total	6,742	6,701	99.4%

Source: Massport, HMMH 2011.

Statistical Analyses of Flight Tracks - Runways 22R/22L

The Squantum 2 and Hull 1 Gates (Figure H-14) are used to monitor the turn to 140 degrees over Boston Harbor and north of Hull. The shoreline gates are used to monitor shoreline crossings, as for Runways 4R, 9, and 15R above.

Table H-19 shows the dispersion of the jet departures from Runways 22R-22L as they pass through the Squantum 2 Gate. The first segment of the gate is the northernmost segment and is primarily over Boston Harbor. The other segments extend southward toward Quincy. Unlike in 2010, when over 90 percent of the flights were over the first two segments of this gate, only 79.0 percent of the flights were over these two segments in 2011. This is due to an increase in flights over the third segment from 8.9 percent in 2010 to 20.9 percent in 2011.

Table H-19 Runways 22R/22L Squantum 2 Gate Summary for 2011

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
0 - 12,000 ft	20,590	56,748	36.3%
12,000 - 14,000 ft	24,207	56,748	42.7%
14,000 - 21,000 ft	11,888	56,748	20.9%
21,000 - 27,000 ft	63	56,748	0.1%
Total	56,748	56,748	100.0%

Source: Massport, HMMH 2011.
Note: Percentages sum to more than 100 percent due to rounding.

Table H-20 shows that 98.0 percent of the tracks were north of the Hull peninsula as they passed through the Hull 1 Gate, which is an increase from 2010 (96.7 percent).

Table H-20 Runways 15R/22R/22L Gate Summary – North of Hull Peninsula for 2011

	Number of Tracks Through Gate	Number of Tracks North of Hull Peninsula	Percentage of Tracks North of Hull Peninsula
Hull 1 Gate	64,814	63,530	98.0%

Source: Massport, HMMH 2011.

Table H-21 indicates that 99.4 percent of Runway 22R/22L departures were above 6,000 feet when crossing the shoreline, as compared with 97.2 percent in 2010. For the Revere gate, the percent above 6,000 feet decreased from 97.7 percent in 2010 to 97.5 percent in 2011. The Swampscott gate also decreased from 99.7 percent in 2010 to 99.5 percent in 2011. The Marblehead gate had an increase in crossings (from 8,385 in 2010 to 14,791 in 2011) and an increase in the percent above 6,000 feet (from 99.5 percent in 2010 to 99.9 percent in 2011). The Hull 2 gate decreased in percent above 6,000 feet from 97.0 percent in 2010 to 96.6 percent. The Hull 3 gate increased in percent above 6,000 feet from 94.9 in 2010 to 96.2 percent in 2011. The number of crossings for the Cohasset gate increased (11,800 in 2010 versus 34,102 in 2011) and the percentage increased from 97.7 percent in 2010 to 99.3 percent in 2011.

Table H-21 Runways 22R/22L Shoreline Crossings Above 6,000 Feet for 2011

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Revere Gate	40	39	97.5%
Swampscott Gate	409	407	99.5%
Marblehead Gate	14,791	14,778	99.9%
Hull 2 Gate	58	56	96.6%
Hull 3 Gate	1,422	1,368	96.2%
Cohasset Gate	34,102	33,859	99.3%
Total	50,822	50,507	99.4%

Source: Massport, HMMH 2011.

Runway 27

On September 15, 1996, the FAA implemented a new departure procedure for Runway 27 called the WYLYY RNAV procedure. In accordance with the provisions of the ROD issued for the Runway 27 Environmental Impact Statement (EIS), Massport has been providing on-going radar flight track data and analysis to the FAA with respect to the new procedure.

For the first time since 1997 when flight track monitoring began, each gate (Gates A-E) averaged over 68 percent for an annual average. In addition, since the WYLYY EIGHT was published in March, every recorded month had 68 percent or greater for each gate. The percent of flight tracks through all gates (a number tracked but not required per the 1996 ROD) rounded up to 68 percent for the last two months of 2011. These last two months would have captured the additional flights using the WYLYY NINE after the October 20th modification. The FAA had discussed this data internally and concluded that acceptable flight track dispersion had been achieved and that no subsequent action by FAA is required per the 1996 ROD requirements[7].

Massport will continue to provide Table H-22 in the subsequent annual reports. Table H-22 presents the results for the Runway 27 corridor complied for 2011. The average percentage of tracks through the corridor was 59.6 percent, an increase from 53.5 percent for 2010 and an increase from 50.2 percent for 2009.

Table H-22 Runway 27 Corridor Percent of Tracks Through Each Gate for 2011

Month	Total # of Tracks	Total # of Tracks Through All Gates	Percent of Tracks Through All Gates	Gate A 1,400 ft[1]	Gate B 2,200 ft[1]	Gate C 2,900 ft[1]	Gate D 4,700 ft[1]	Gate E 6,300 ft[1]	Average Percent Through Each Gate
January	2,643	1,434	54.3%	60.3%	84.1%	94.6%	97.1%	95.0%	86.2%
February	1,801	947	52.6%	59.3%	83.2%	94.9%	97.5%	96.0%	86.2%
March	2,261	1,373	60.7%	72.6%	81.9%	91.7%	96.0%	93.0%	87.0%
April	1,210	782	64.6%	78.5%	82.4%	88.4%	92.2%	88.8%	86.1%
May	345	227	65.8%	76.5%	78.3%	90.7%	91.6%	91.6%	85.7%
June	473	284	60.0%	80.1%	78.2%	87.9%	90.9%	85.0%	84.4%
July[2]									
August[2]									
September[2]									
October	650	413	63.5%	74.0%	83.5%	89.7%	94.2%	92.0%	86.7%
November	197	133	67.5%	78.7%	86.3%	92.9%	99.0%	91.9%	89.7%
December	1,376	934	67.9%	79.2%	84.1%	93.5%	97.8%	95.0%	89.9%
Average[2]	996	594	59.6%	73.2%	82.5%	91.6%	95.1%	92.0%	86.9%

Source: Massport, HMMH 2011
Gray shading indicates the Percentage rounds up to 68% or greater.
1 Width of Each Gate in Feet.
2 Runway 33L completely closed July 1 - Sept. 30, RSA project, reduced use of Runway 27 departures. Excluded from overall average.

7 Logan Airport Runway 27 Advisory Committee Meeting - January 23, 2012 meeting minutes

Statistical Analyses of Flight Tracks — Runway 33L

The Somerville and Everett Gates (Figure H-14) extend from BOS 2 DME to BOS 5 DME and are used to monitor the departure procedure for Runway 33L. Turns to the left prior to the BOS 2 DME would pass through the Somerville Gate. Turns to the right prior to the BOS 2 DME would pass through the Everett Gate. Table H-23 shows the results of the analyses. The table indicates that in 2011 8.0 percent of tracks turned prior to reaching the BOS 2 DME. This is an increase compared to 2010 when 6.2 percent of departures turned early before reaching 2 DME. The total number of tracks decreased from 25,047 in 2010 to 12,894 in 2011. This large decrease in tracks occurred because Runway 33L was closed for 3 months during 2011.

Table H-23 Runway 33L Gates — Passages Below 3,000 Feet for 2011

	Number of Departure Tracks	Number of Tracks Turning Before BOS 2 DME	Percentage of Tracks Turning Before BOS 2 DME
Everett Gate	12,894	134	1.0%
Somerville Gate	12,894	900	7.0%
Total	12,894	1,034	8.0%

Source: Massport, HMMH 2011.

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TECHNICAL MEMORANDUM

Subject:	Runway 22R Departure Analysis
Prepared for:	Flavio Leo; Massport
Prepared by:	Robert Mentzer Jr., Sean Doyle, Chris Waite; HMMH
Date:	12/20/2011
Reference:	HMMH Project 304090.002.005

This memorandum is in response to a request from Massport to analyze Runway 22R departures at Logan International Airport (BOS) under HMMH's on-call contract with the Noise Office. The request was to compare jet departures from Runway 22R at BOS from December 2009 to October 2010 and from December 2010 to October 2011. This request was a result of inquiries from the South Boston community who were experiencing more overflights than in the past. Since the implementation of area navigation (RNAV) procedures, departures from Runway 22R were appearing to remain on runway heading longer than they had before, thereby resulting in increased overflights in the Farragut Road area.

1. BACKGROUND

A Categorical Exclusion/Record of Decision (CATEX/ROD[1]) for the Boston Overflight Noise Study was issued in October 2007. The CATEX/ROD approved the development of an RNAV-based Standard Instrument Departure (SID) procedure and an updated conventional vector route for non-RNAV equipped aircraft for Runways 22R/L along with similar improvements for other runways at BOS.

The FAA began design of the proposed procedures in early 2009. For 22L/R, the aircraft would depart and turn to a vector heading as they did before, and then join the RNAV procedure north of Hull. The procedure was designed and submitted to FAA in March of 2009. However, the FAA National RNAV office determined that the Vector to RNAV procedure for 22R/L was not feasible due to inadequate Distance Measuring Equipment (DME) coverage in the area.

Following that determination, FAA began the development of a full RNAV SID from Runway 22R/L which would be successful in meeting the spirit and intent of the CATEX/ROD. These were completed and submitted in June of 2009 and the procedures were published and implemented for Runway 22R/L in November of 2010.

[1] Boston Overflight Noise Study – Phase 1 RNAV Design Updates, June 17, 2009

A total of eight RNAV SIDs are published for BOS: (BLIZZR, BRUWN, CELTK, HYLND, LBSTA, PATSS, REVSS, and SSOXS). Each of the RNAV procedures developed for Runway 22R consists of a heading to altitude (VA) segment and direct to fix (DF) segment which instruct the aircraft to turn to the fix TJAYY any time after reaching 520 feet MSL.

2. RUNWAY 22R DEPARTURE EVALUATION

Radar data from the Massport Noise and Operations Monitoring System (NOMS) was used for this analysis. The conventional vector (pre-RNAV) departures were represented by a data set from December 2009 to October 2010. During this 335-day period, 218 days had departures from Runway 22R, including 43,335 jet operations. The RNAV departures were represented by a data set from December 2010 to October 2011, also 335 days in length. Out of this sample, 219 days had departures from Runway 22R and included 46,575 jet operations, 3,240 more than the pre-RNAV set. This increase is probably due to the Runway 15R/33L Runway Safety Area construction in 2011 which closed Runway 15R/33L for several months.

Figure 1 shows the area surrounding Logan Airport on which this analysis focuses. Three reference points were used to evaluate the changes in departures and are shown in Figure 1. The three sites are:

- The Marine Park Ball Field
- A private residence at 73 Farragut Road
- RMT3, one of the noise monitoring stations operated by Massport

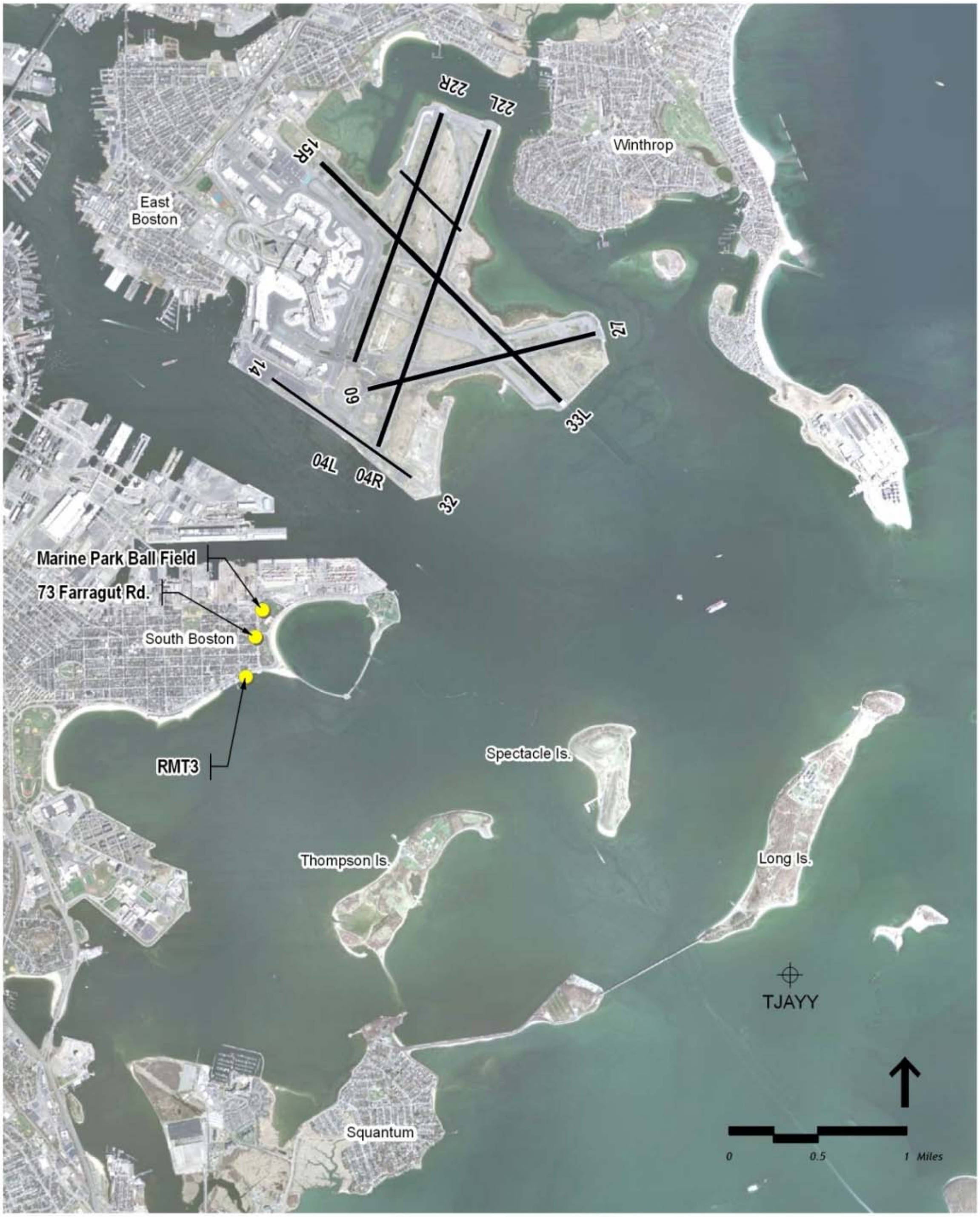
For reference, Figure 1 also shows the location of TJAYY, the first waypoint aircraft must fly-by when on the new RNAV departure procedure.

2.1 Density Plots

Figure 2 shows a plot of the density of aircraft departures off of Runway 22R from December 2009 to October 2010, before RNAV procedures were implemented. The figure indicates that the majority of flights turn immediately after reaching the northern shore of Boston Inner Harbor and pass over Castle Island, Spectacle Island and approximately one mile north of waypoint TJAYY over Long Island.

Figure 3 shows a comparable density plot of aircraft departing Runway 22R from December 2010 to October 2011, after RNAV procedures were implemented. It shows the bulk of the aircraft making a more gradual turn after reaching the northern edge of Boston Inner Harbor, passing to the west of Castle Island and over the southern edge of Spectacle Island heading towards a fly-by of the TJAYY waypoint.

The highest density of departure tracks for both pre-RNAV and RNAV procedures occurs over the water and not over the three reference points. As shown in Figure 2 and 3 there is, however, a consolidation and small shift in the central track densities between the pre-RNAV and RNAV operations, which could quite conceivably account for the perceived increase in the number of over-flights with RNAV operations.



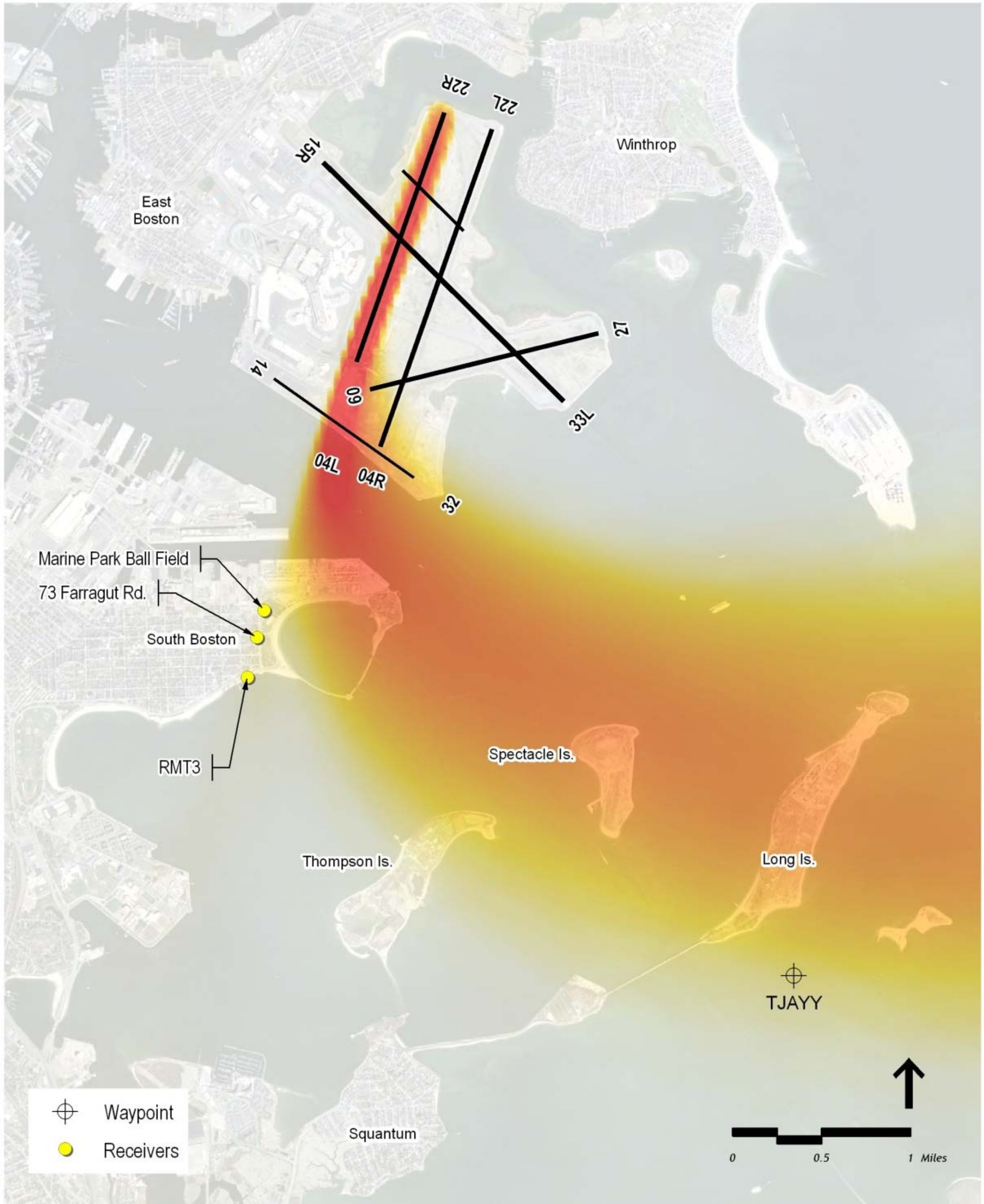
Source: Harris Miller Miller & Hanson Inc. 2010, Massport NOMS / ERA Multi-Lat, Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Project Area and Modeling Locations

Waypoint

Receivers

Figure 1

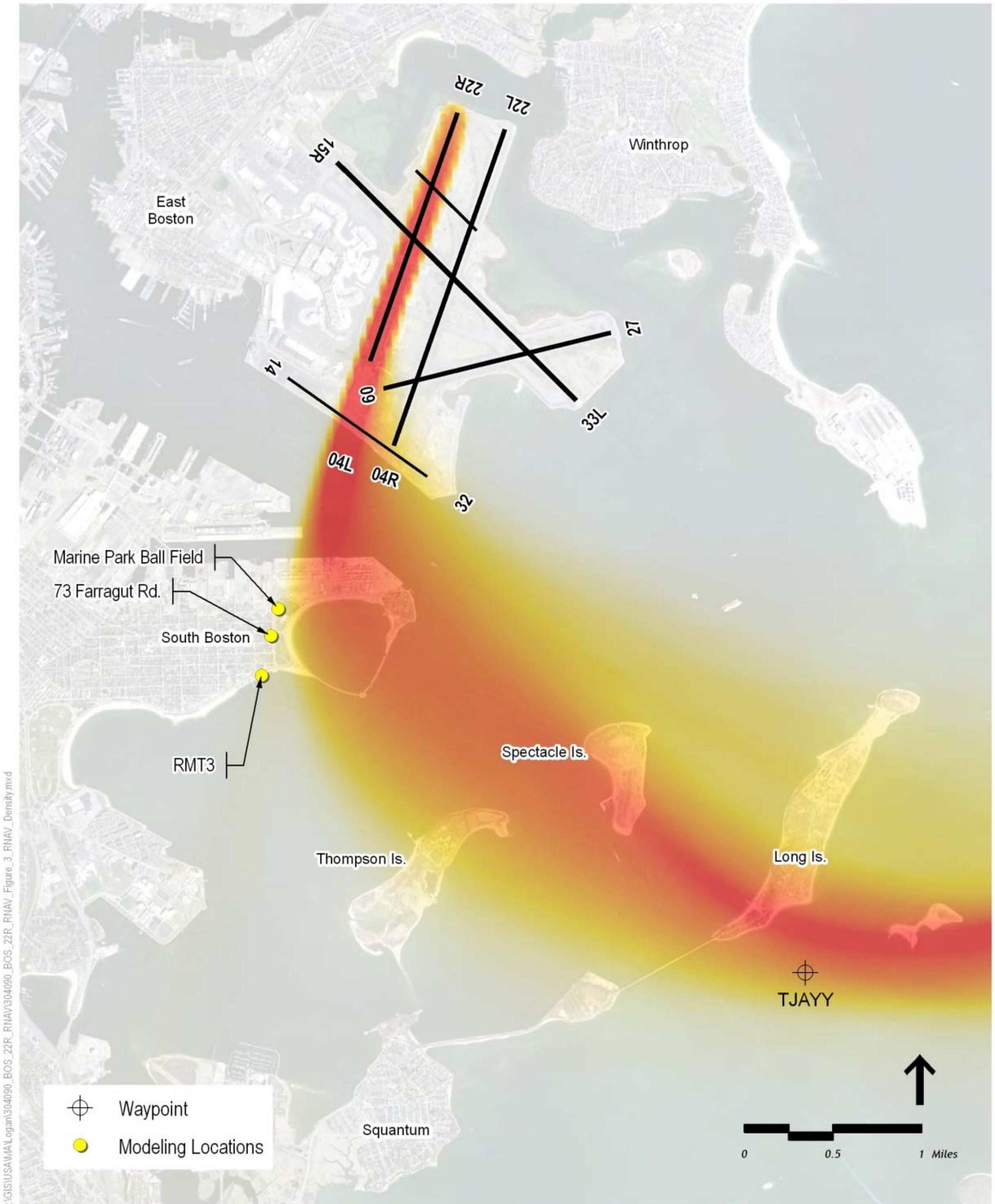


Source: Harris Miller Miller & Hanson Inc. 2010, Massport NOMS / ERA Multi-Lat, Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Low Medium High

BOS pre-RNAV (December 2009-October 2010)
Runway 22R Departure Track Density Plot
(43,335 Flight Tracks)

Figure 2



Source: Harris Miller Miller & Hanson Inc. 2010, Massport NOMS / ERA Multi-Lat, Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Low Medium High

BOS RNAV (December 2010-October 2011) Runway 22R Departure Track Density Plot (46,575 Flight Tracks)

Figure 3

2.2 Point of Closest Approach

To compare the two scenarios more quantitatively, a Point of Closest Approach (POCA) analysis was completed to determine whether there were any trends or specific airline or aircraft types that were not turning as soon as they had prior to the implementation of the RNAV procedure. The slant distance which is the direct distance between the aircraft and the location, was used for this analysis. The slant distance was used since it will reflect changes in both track position and altitude. The following tables compare airlines and aircraft departing Runway 22R during each period. Table 1 reports the operators with the highest numbers of departures from Runway 22R and Table 2 reports the aircraft types with the highest numbers of departures from Runway 22R. The tables are sorted from the largest to smallest difference in slant distance.

Table 1. Point of Closest Approach by Operators to 73 Farragut Rd.

Operator ICAO	Operator Name	Operations		Slant Distance (ft.)		
		Pre-RNAV	RNAV	Pre-RNAV	RNAV	Difference
EGF	AMERICAN EAGLE AIRLINES Inc.	2,847	1,551	5,042	3,177	-1,865
UAL	UNITED AIRLINES Inc.	2,240	2,201	4,852	3,330	-1,522
JZA	AIR CANADA JAZZ	1,030	1,035	4,616	3,443	-1,173
ACA	AIR CANADA	601	671	4,419	3,300	-1,119
FLG	PINNACLE AIRLINES Inc.	226	203	4,476	3,371	-1,105
AAL	AMERICAN AIRLINES Inc.	2,883	2,947	3,926	2,859	-1,067
CHQ	CHAUTAUQUA AIRLINES Inc.	346	401	4,232	3,200	-1,032
AWI	AIR WISCONSIN AIRLINES Corp.	1,055	1,007	3,824	2,853	-971
VRD	VIRGIN AMERICA Inc.	555	529	3,433	2,496	-937
ICE	ICELANDAIR	102	153	3,499	2,604	-895
NKS	SPIRIT AIRLINES Inc.	377	486	4,094	3,208	-886
JBU	JETBLUE AIRWAYS Corp.	7,411	9,582	4,139	3,272	-867
UPS	UPS Airlines	137	176	5,274	4,448	-826
RPA	REPUBLIC AIRLINES	897	681	4,529	3,712	-817
TCF	SHUTTLE AMERICA Corp.	461	599	4,692	3,890	-802
ASA	ALASKA AIRLINES Inc.	204	197	3,469	2,683	-786
DAL	DELTA AIR LINES Inc.	4,086	4,262	4,245	3,545	-701
BAW	BRITISH AIRWAYS	314	343	3,166	2,476	-690
BTA	EXPRESSJET AIRLINES Inc.	250	196	2,902	2,223	-679
CPZ	COMPASS AIRLINES	146	224	4,241	3,640	-601
TRS	AIRTRAN AIRWAYS Inc.	2,032	2,072	3,811	3,236	-575
EJA	NETJETS AVIATION Inc.	572	611	4,975	4,406	-569
COA	CONTINENTAL AIRLINES Inc.	1,377	1,523	3,884	3,372	-511
COM	COMAIR Inc.	1,581	1,166	3,473	3,021	-452
FDX	FEDEX EXPRESS	347	409	3,692	3,319	-373
MES	MESABA AIRLINES	166	408	3,272	2,909	-362
EIN	AER LINGUS	176	187	3,410	3,062	-347
AWE	AMERICA WEST AIRLINES Inc.	5,280	5,420	4,819	4,486	-332
SWA	SOUTHWEST AIRLINES Co.	1,908	2,785	4,828	4,644	-184
	Total	39,607	42,025			
	Average			4,111	3,317	-795

Table 2. Point of Closest Approach by Aircraft to 73 Farragut Rd.

Aircraft ICAO	Aircraft Description	Operations		Slant Distance (ft.)		
		Pre-RNAV	RNAV	Pre-RNAV	RNAV	Difference
E135	Embraer RJ135	2894	1335	5037	3137	-1901
MD88	McDonnell Douglas MD-88	1242	385	4012	2275	-1737
B752	Boeing 757-200	3489	4075	4338	2693	-1645
B763	Boeing 767-300	237	165	4207	2834	-1373
F2TH	Dassault Falcon 2000	131	149	4749	3700	-1049
CRJ2	Bombardier CRJ400	1904	1577	4076	3061	-1014
CARJ	Canadair Regional Jet	55	161	3786	2869	-917
A320	Airbus A320	6045	6812	4206	3318	-888
B734	Boeing 737-400	217	277	3865	2986	-880
E145	Embraer RJ145	606	657	3744	2904	-840
B733	Boeing 737-300	135	188	4519	3693	-827
E170	Embraer 170	1900	1770	4517	3721	-796
H25B	Raytheon Hawker 850XP	239	231	4264	3492	-772
GLF4	Gulfstream GIV	195	167	4448	3713	-736
E190	Embraer 195	6353	7091	4533	3835	-699
CRJ1	Bombardier CRJ100	1593	664	3930	3245	-685
B712	Boeing 717-200	1573	1622	3780	3104	-676
C56X	Cessna 560XL Citation Excel	263	303	5549	4874	-675
A306	Airbus A300-600	196	201	5333	4665	-668
A319	Airbus A319	3885	5953	4798	4142	-657
CL30	Bombardier Challenger 300	103	122	5249	4600	-648
A343	Airbus A340-300	213	221	2778	2163	-615
B772	Boeing 777-200	185	139	3711	3108	-603
B735	Boeing 737-500	527	501	3965	3412	-552
BE40	Raytheon Hawker 400	218	224	4998	4467	-531
CL60	Bombardier Challenger 600	155	151	4274	3767	-508
C750	Cessna 750 Citation X	189	198	4392	3890	-502
A333	Airbus A330-300	148	148	3325	2874	-451
B744	Boeing 747-400	218	295	2628	2178	-450
C560	Cessna 560 Citation	151	129	4979	4530	-448
A346	Airbus A340-600	61	107	2841	2404	-437
B739	Boeing 737-900	33	109	3292	2869	-423
A332	Airbus A330-200	160	207	3395	2974	-420
B738	Boeing 737-800	2255	2732	3562	3156	-407
C680	Cessna 680 Citation Sovereign	119	112	5514	5121	-393
CRJ7	Bombardier CRJ700	211	1415	3946	3569	-377
CRJ9	Bombardier CRJ900	534	853	3173	2843	-330
DC10	McDonnell Douglas DC-10	197	250	3054	2739	-315
A321	Airbus A321	156	158	4070	3771	-299
B737	Boeing 737-700	2529	3271	4637	4494	-143
Total		41,514	45,125			
Average				4,137	3,430	-707

Across all operators and aircraft types the RNAV procedures result in a decreased slant distance at the reference location. Airlines such as American Eagle and United are near the top of the list due to the type of aircraft in their fleet. The E135 aircraft and the B752 aircraft have some of the largest differences and these dominate the respective fleets. The change in B752 departures is discussed in more detail and can be seen in Figure 11 in Section 2.5. The B722 aircraft of FedEx are not RNAV equipped, which is why FedEx is near the bottom of the list. Air Lingus is near the bottom due to the fact that its flights are all long haul operations.

One notable distinction to identify in the data shown in Table 1 is the smaller overall changes between the pre-RNAV and RNAV time periods for America West (AWE) and Southwest (SWA) airlines. These small differences between the two time periods are not due to the type of aircraft in their fleet but the fact that they are not using the RNAV procedure when it is available to them. This is evident in comparing AWE or SWA flights between the two periods. SWA flights can be seen in Figure 10 in Section 2.4.

In Table 2, the E135, MD88 and B752 are the aircraft types with the largest differences. This suggests that these aircraft types do not perform as well as others to turn to the TJAYY point. They appear to be making a long slow turn to TJAYY to get onto a 93 degree heading to the next fix. The B737 aircraft is at the bottom the list, not because it is not RNAV-equipped like the DC10 but because the primary operator, Southwest, is not flying the procedure.

2.2.1 Overall POCA Changes with RNAV implementation

At each of the modeled locations shown on Figure 1 the mean, average and peak slant distances all show a decrease of between 700' and 1,250' and are summarized in Table 3.

Table 3. Change in Slant Distance for Point of Closet Approach between RNAV and Pre-RNAV operations

Site	Mean Change (ft.)	Average Change (ft.)	Peak Change (ft.)
Marine Park Ball Field	-787	-700	-950
73 Farragut Rd.	-876	-784	-1,200
Noise Monitor RMT3	-987	-893	-1,250

2.3 DNL Evaluation

RealContours™[2] was run on just the Runway 22R jet departures to evaluate possible changes in noise levels due to the implementation of the RNAV. All Runway 22R jet departures were modeled within each time period and adjusted to represent average day conditions. Figure 7 compares partial DNL contour lines for aircraft departing off of Runway 22R before and after the implementation of the RNAV procedures. The pre-RNAV DNL contours (blue) are several hundred feet west of the RNAV DNL contours (orange). The contour is also slightly larger along the start of takeoff roll and extends further out into Boston Harbor. The differences in the size of the contour are due to the

[2] RealContours™ is a pre-processor for the FAA's INM model which converts radar data into model tracks. This allows the actual radar tracks to be modeled instead of a sampled average.

number of departures modeled and the mix of aircraft types during the two time periods. The RNAV set (46,575 departures) does include a higher number of departures than in the pre-RNAV set (43,335 departures). The increase in operations is most likely due to the closure of Runway 15R-33L during part of 2011.

To allow for the comparison between two sets which are similar the RNAV set was normalized to represent the noise contours with the same number of operations as the Pre-RNAV DNL contours. Figure 8 displays the pre-RNAV DNL contours compared to the normalized RNAV DNL contours (yellow). The reduction in the contour size when compared to the original RNAV DNL contour in Figure 7 is very small and as shown in Table 4 resulted in a reduction of 0.2dB at those sites.

The shift of the contour towards South Boston and the elongation of the contour into Boston Harbor reflect the changes in flight paths due to the implementation of the RNAV procedures. The RNAV reduces the spread of the track dispersion and in turn reduces the width and elongates the contour along the flight path.

Table 4 presents the partial DNL results of the modeling at each of the locations evaluated. As shown in Figure 1 each of the three sites are successively farther away from the runway end. The partial DNLs decrease as the majority of aircraft turn to the desired fix. The implementation of the RNAV procedures have resulted in aircraft turning more gradually from runway heading and falling closer to the modeling locations resulting in almost a DNL 4 dB increase at each site.

Table 4. Partial DNL levels at Selected Sites for Runway 22R Departures

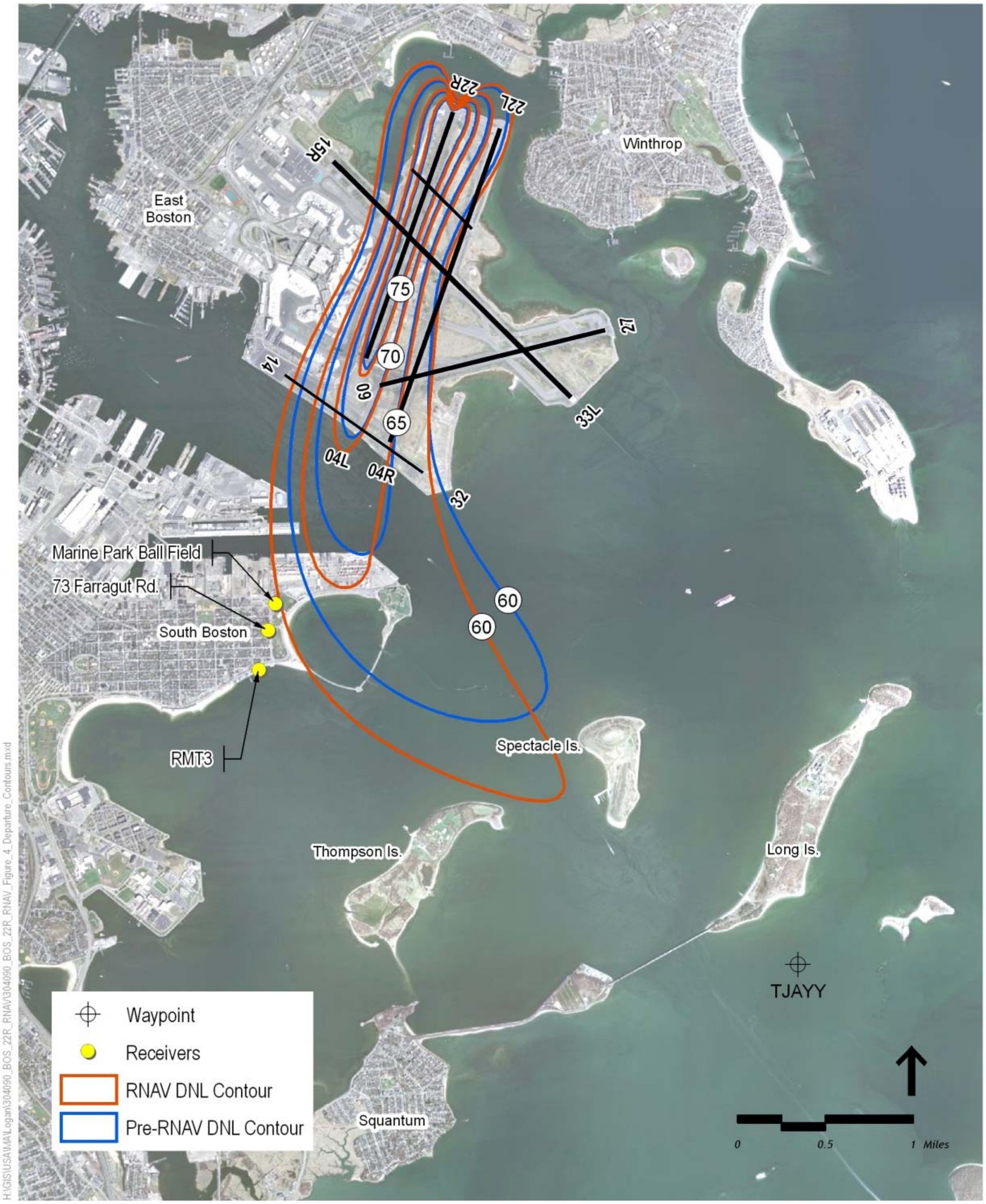
Site		Un-Normalized		Normalized	
	Pre-RNAV	RNAV	Change	RNAV	Change
Marine Park Ball Field	55.4	59.3	3.9	59.1	3.7
73 Farragut Rd.	53.7	57.6	3.9	57.4	3.7
Noise Monitor RMT3	51.5	55.2	3.7	55.0	3.5

Normalized levels correct for difference the difference in overall operations between the two time periods to provide for the best representation of differences due to the departure route changes.

Table 5 displays the modeled noise levels at each of the selected sites from the 2010 EDR. The modeling for the 2010 EDR overlaps the majority of the pre-RNAV period (10 of the 11 months). The 2010 EDR results were adjusted at each site to include the RNAV period 22R departures instead of the pre-RNAV period 22R departures. This was done to evaluate the amount of change on an annual average basis which would include noise contributed from all of the other operations at Logan Airport. As other operations at the airport contribute to noise levels at these locations the increase due to the shift of the RNAV tracks is minimized and is equal to or less than 1.5 dB at each of the sites.

Table 5. Annual Average DNL levels at Selected Sites

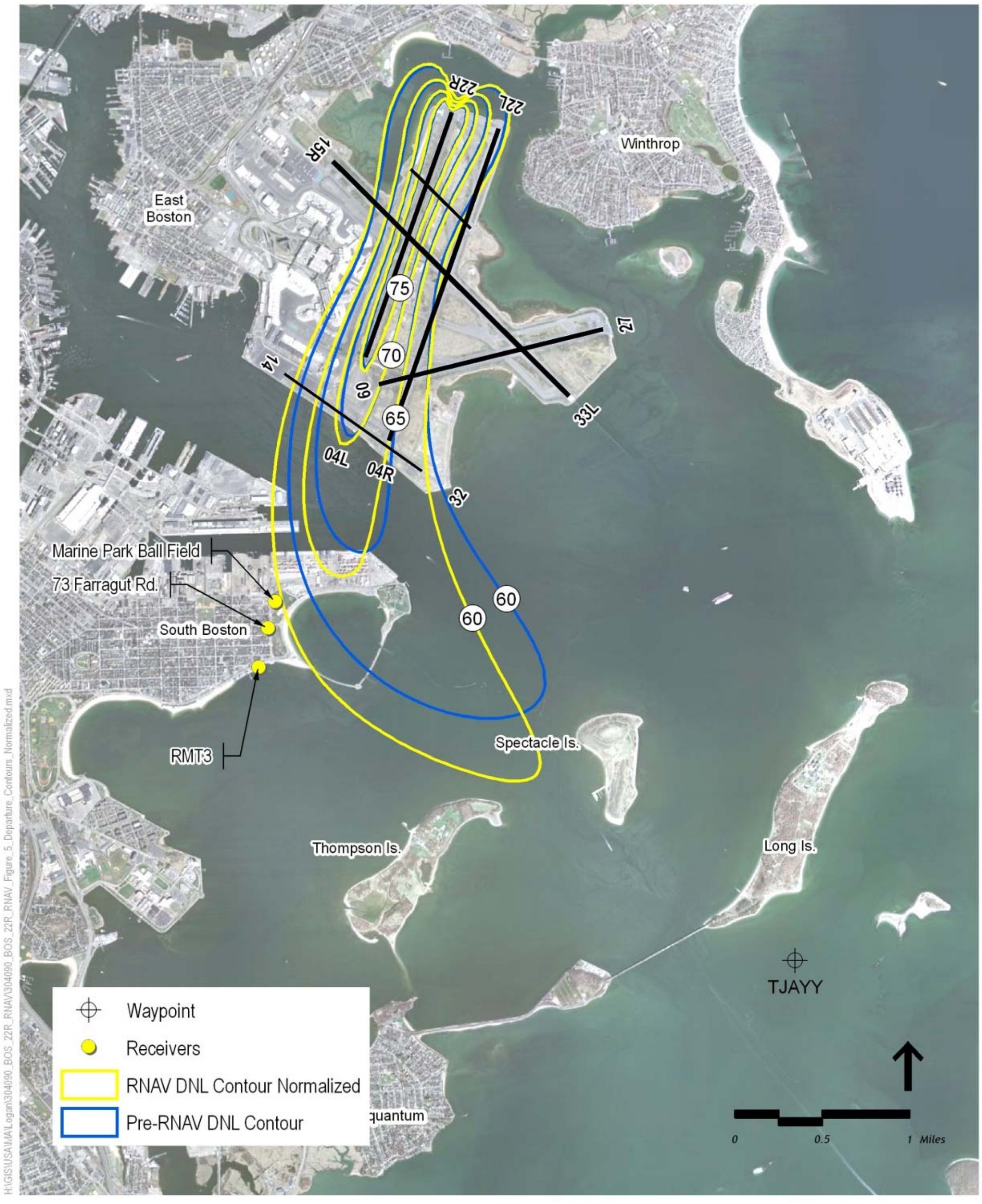
Site	2010 EDR	2010 EDR adjusted for RNAV	Change
Marine Park Ball Field	60.5	62.0	1.5
73 Farragut Rd.	60.7	61.8	1.0
Noise Monitor RMT3	59.4	60.2	0.8



Source: Harris Miller Miller & Hanson Inc. 2010, Massport NOMS / ERA Multi-Lat, Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Runway 22R Departure Partial DNL contours, BOS pre-RNAV (December 2009-October 2010) vs BOS RNAV (December 2010-October 2011)

Figure 7



Source: Harris Miller Miller & Hanson Inc. 2010, Massport NOMS / ERA Multi-Lat, Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Runway 22R Departure Partial DNL contours, BOS pre-RNAV (December 2009-October 2010) vs BOS RNAV (December 2010-October 2011) Operations Normalized
Figure 8

2.4 Track Comparisons

The following figures display differences between the pre-RNAV and RNAV time periods for two airlines and aircraft types at Logan Airport.

Figure 9 displays the typical change in flights between the pre-RNAV and RNAV time periods. These are JetBlue A320 departures and you can see the aircraft turning to 140 degrees using the standard LOGAN SID (orange tracks) during the pre-RNAV period. The flights typically stay east of Pleasure Bay. The green tracks are the JetBlue departures during the RNAV period and you can clearly see the shift over Pleasure Bay and the concentration of the tracks along the RNAV route.

Figure 9 - JetBlue A320 Departures from the pre-RNAV Time Period (Orange) and RNAV Time Period (Green)

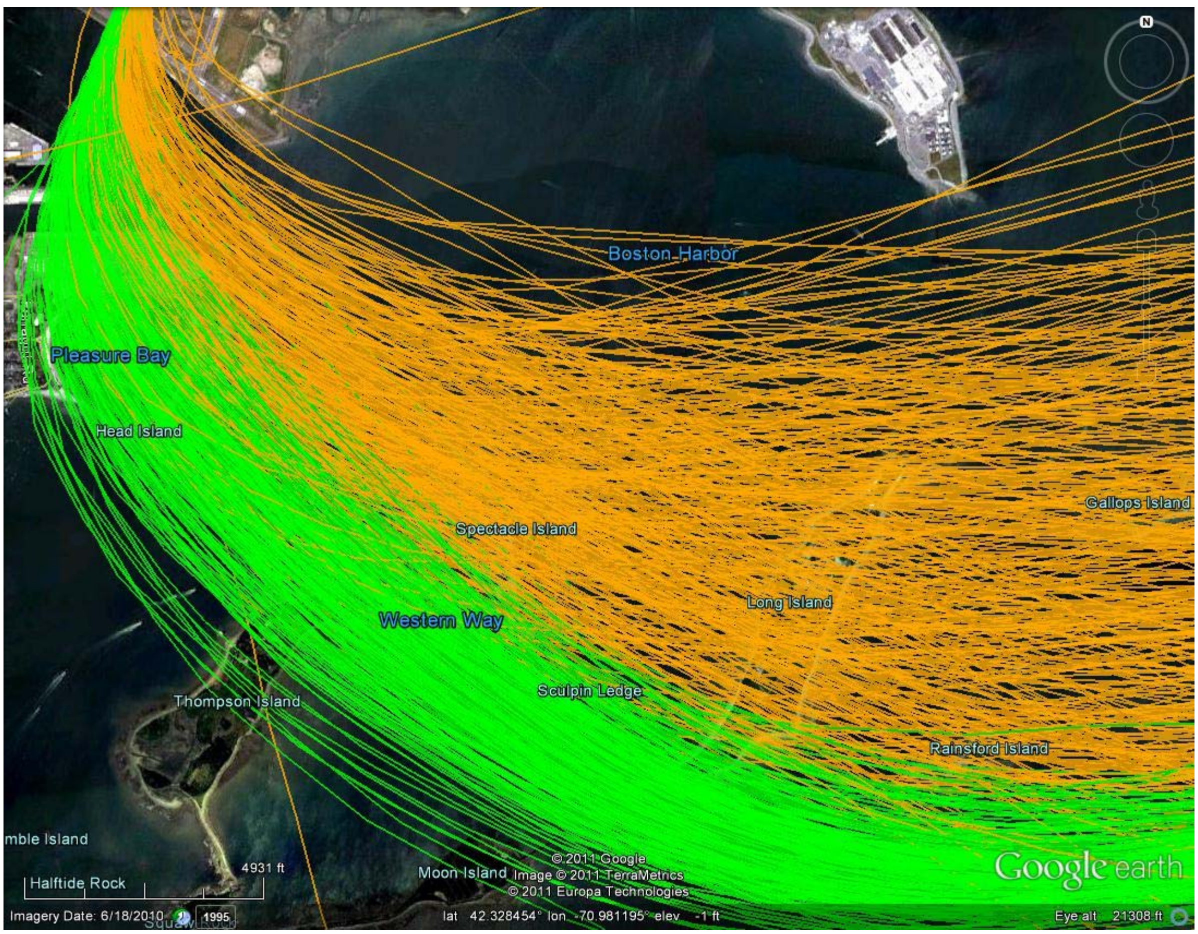
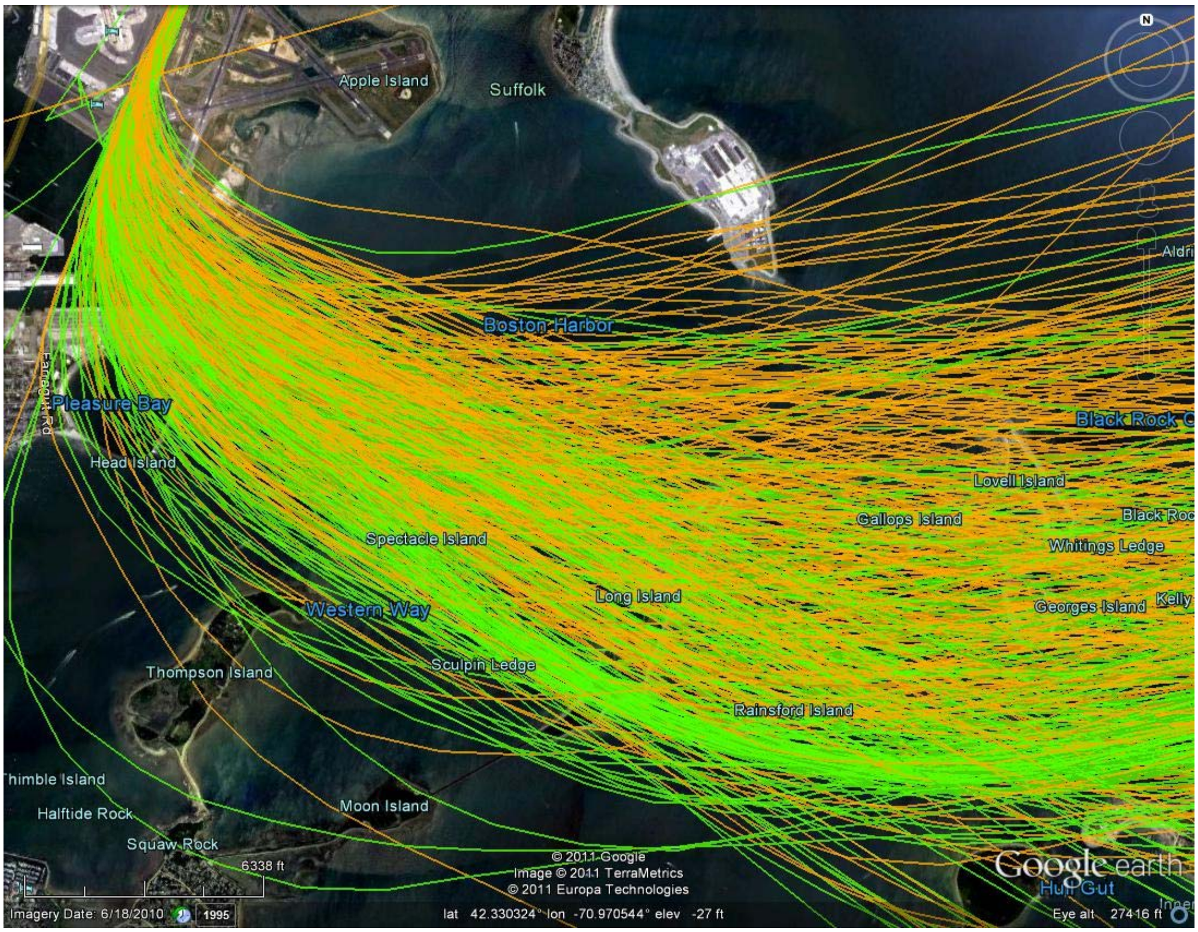


Figure 10 displays the Southwest departures (B737 & B733 aircraft) during both time periods. Unlike Figure 9, the majority of the flights follow the standard LOGAN SID during both periods and you can clearly see most of Pleasure Bay to the left of the graphic. The pre-RNAV tracks are orange and the RNAV time period tracks are green. There are some flights that follow the RNAV and can be seen as the concentrated green band near the bottom of the graphic.

Figure 10 - Southwest B737 and B733 Departures from the pre-RNAV Time Period (Orange) and RNAV Time Period (Green)

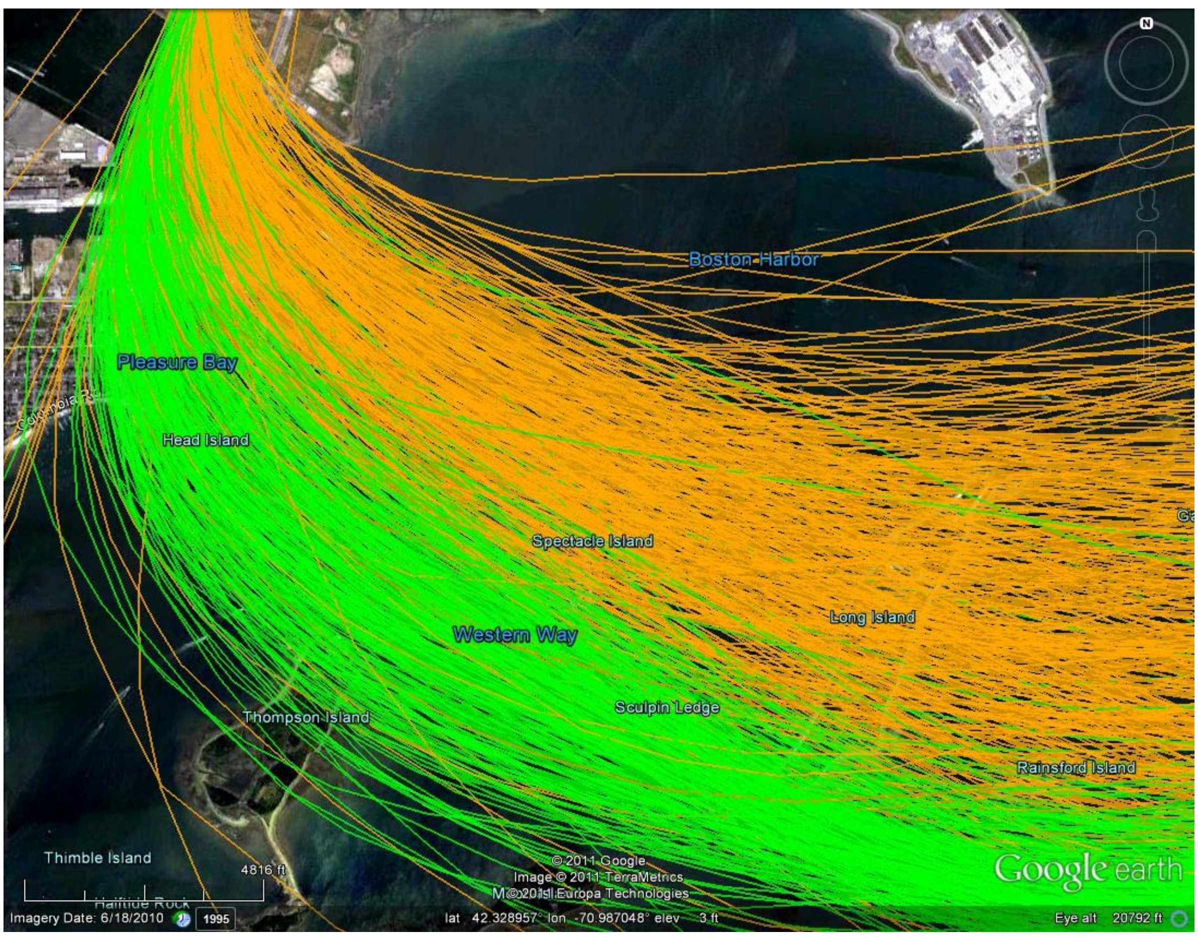


2.5 Boeing 757-200 Case Study

Figure 11 displays the change in flights between the pre-RNAV and RNAV time periods for Boeing 757-200 (B752) aircraft which has one of the largest shifts in slant distance at 73 Farragut Rd. The B752 departures are turning to 140 degrees using the standard LOGAN SID (orange tracks) during the pre-RNAV period. The flights typically stay east of Pleasure Bay. The green tracks are the B752 departures during the RNAV period and you can clearly see the shift over Please Bay and the concentration of the tracks along the RNAV route.

The B752 aircraft has one of the largest shifts in slant distance (1,645 feet) and one of the higher levels of operations between the two time periods. In the pre-RNAV period there were 3,489 departures with an average slant distance of 4,338 feet at 73 Farragut Rd. During the RNAV period there were 4,075 departures with an average slant distance of 2,693. The B752 is also not dominated by one airline; AAL, UAL and DAL are the major operators of the B752 in this analysis with AAL having the largest percentage of these flights.

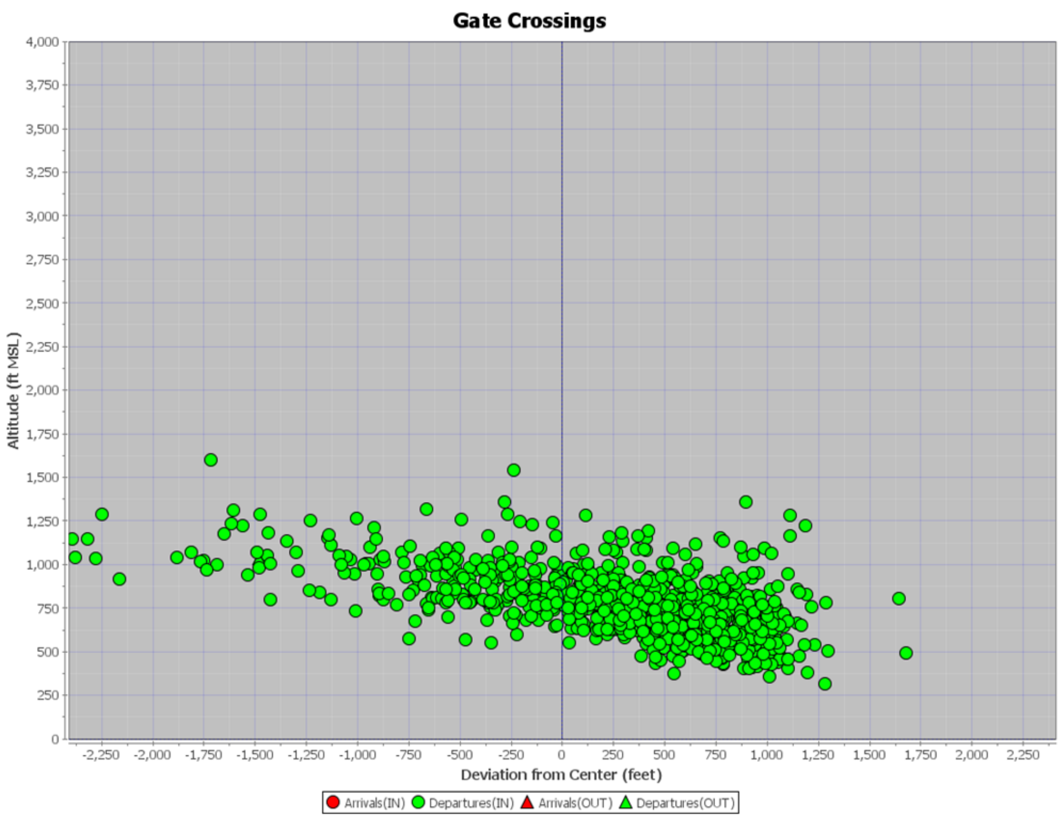
Figure 11 - B752 Departures pre-RNAV Time Period (Orange) and RNAV Time Period (Green)



As shown in Figure 11, B752 aircraft prior to the implementation of the RNAV turned to a 140 degree heading after takeoff from Runway 22R. This resulted in the aircraft turning as it crossed Runway 14-32 and the shoreline at the airport, whereas during the RNAV period, the flights are concentrated along runway heading as they cross Runway 14-32 and the airport shoreline. This difference is evident in the top of the Figure 11graphic near the airport where the green RNAV flight tracks are concentrated as they cross the airport shoreline.

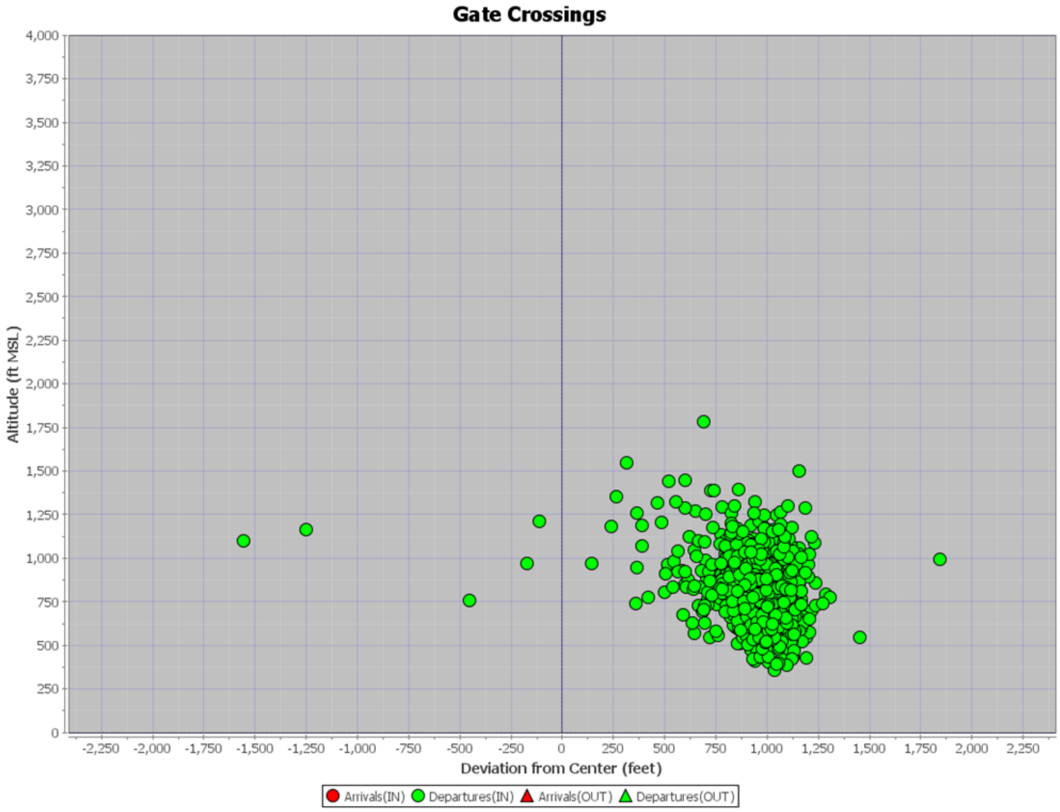
To capture this, a gate placed along the shoreline shows this difference in the B752 departures. Figure 12 shows the spread of the departures as the B752 aircraft turn out over the harbor as the cross the airport shoreline. The Runway 22R extended centerline lies at approximately 1,000 feet to the right of the gate center. The majority of the B752 departures are above 520 feet MSL and the spread indicates that many of the aircraft have turned from runway heading as soon as they are able to.

Figure 12 - B752 pre-RNAV Time Period Departures at Shoreline Gate



In contrast, Figure 13 shows the same gate with B752 departures during the RNAV period. The concentration of the departures along the runway centerline is due to the aircraft systems following the RNAV procedures. The RNAV procedure indicates the aircraft can turn any time after 520 feet MSL however the majority of the flights are still on runway heading and above 520' MSL. The gate crossings in Figure 13 indicate that the B752 aircraft are engaging the turn to TJAYY later than they have too.

Figure 13 - B752 RNAV Time Period Departures at Shoreline Gate



3. CONCLUSIONS

The overall result of initiating the RNAV SID procedure to Runway 22R departures has caused the majority of operations, regardless of aircraft type or operator, to fall closer to the three reference locations at Marine Park, 73 Farragut Road and the noise measurement site RMT3. This has resulted in an increase in aircraft overflights and modeled noise levels at these sites due to Runway 22R departures only by almost 4 dB. On an annual average basis combined with the other operations at the airport the increases are on the order of 1 to 1.5 dB. This has also resulted in a shift in the DNL contour closer to the South Boston community.

This is a result of the aircraft flying the RNAV procedure engaging the turn to TJAYY later than they turned when flying the LOGAN SID. This may be due to the aircraft performance and how the aircraft FMS system fly's the procedure. The pilot will fly the procedure following the systems directions to reach the fly-by point.

The RNAV procedure is flown by each aircraft's FMS system and depends on aircraft performance. Since the conformance to the RNAV is aircraft dependent and the aircraft cannot turn prior to reaching 520' MSL but can turn *at any altitude* after 520' MSL this analysis demonstrates that many aircraft types fly a longer gradual turn (lower bank angle) to a fly-by of the TJAYY fix compared to the sharper turn to the 140 degree heading that they used to do.

The standard LOGAN SID instructs the aircraft to turn to a 140 degree heading and pilots turn to this heading as soon as they can do this safely after liftoff. Each aircraft type has different performance

characteristics but most aircraft departing Runway 22R prior to the RNAV procedure turned to this heading and were east of Pleasure Bay.

Runway 22R does have an obstacle departure procedure minimum of 900' MSL before turning *RIGHT*, *which* if not correctly programmed in the FMS, could cause the aircraft to remain on runway heading longer than described in the RNAV procedure.

Solutions to this problem may be to encourage the use of a steeper bank angle, add an additional fix or shift TJAYY slightly north to keep aircraft over Spectacle Island.

Another option that could be explored would be to switch to a heading to intercept (VI) segment followed by a course to fix (CF) segment. In a VI-CF procedure a fly-by point would be added no closer than 1nautical mile to the arrival end of Runway 22R. This would place a fly–by point just north of the container terminal; aircraft would turn before this point and head to TJAYY thereby passing much closer to Castle Island and avoiding the South Boston community.

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Air Quality/ Emissions Reduction

This appendix provides the following detailed information and tables in support of *Chapter 7, Air Quality/ Emissions Reduction*:

- Fundamentals of Air Quality
  - Table I-1 National Ambient Air Quality Standards
  - Table I-2 Airport-related Sources of Air Emissions
  - Table I-3 Attainment, Nonattainment and Maintenance Areas

- Aircraft Fleet and Operational Data Used in EDMS v5.1.3
  - Table I-4 2011 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type
  - Table I-5 2030 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Idle Time-in-Mode by Aircraft Type

- Ground Service Equipment (GSE)/Alternative Fuels Conversion
  - Table I-6 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day)

- Motor Vehicle Emissions
  - Table I-7 MOBILE6.2.03 Input File for 2011
  - Table I-8 MOBILE6.2.03 Output Files for 2011
  - Table I-9 MOBILE6.2.03 Input File for 2030
  - Table I-10 MOBILE6.2.03 Output Files for 2030

- Fuel Storage and Handling
  - Table I-11 Fuel Throughput by Fuel Category for 2011 (gallons)

- Stationary Sources
  - Table I-12 Stationary Source Fuel Throughput by Fuel Category for 2011 (gallons)

Fundamentals of Air Quality

This section contains a general summary of air quality and air emissions with a particular emphasis on airport-related emissions where appropriate. This material is intended to supplement and provide background information for the materials contained in *Chapter 7, Air Quality/Emissions Reduction*.

Pollutant Types and Standards

The United States (U.S.) Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for a select group of "criteria air pollutants" designed to protect public health, the environment, and the quality of life from the detrimental effects of air pollution. Listed alphabetically, these pollutants are briefly described below:

- **Carbon monoxide (CO)** is a colorless, odorless, tasteless gas. It may temporarily accumulate, especially in cool, calm weather conditions, when fuel use reaches a peak and CO is chemically most stable due to the low temperatures. CO from natural sources usually dissipates quickly, posing no threat to human health. Transportation sources (e.g., motor vehicles), energy generation, and open burning are among the predominant anthropogenic (i.e., man-made) sources of CO.
- **Lead** in the atmosphere is generated from industrial sources including waste oil and solid waste incineration, iron and steel production, lead smelting, and battery and lead manufacturing. The lead content of motor vehicle emissions, which was the major source of lead in the past, has significantly declined with the widespread use of unleaded fuel. Low-lead fuel used in some general aviation (GA) aircraft is still a source of airport-related lead.
- **Nitrogen dioxide** (NO_2), nitric oxide (NO), and the nitrate radical (NO_3) are collectively called oxides of nitrogen (NO_x). These three compounds are interrelated, often changing from one form to another in chemical reactions, and NO_2 is the compound commonly measured for comparison to the NAAQS. NO_x is generally emitted in the form of NO, which is oxidized to NO_2. The principal man-made source of NO_x is fuel combustion in motor vehicles and power plants – aircraft engines are also a source. Reactions of NO_x with other atmospheric chemicals can lead to formation of ozone (O_3) and acidic precipitation.
- **Ozone (O_3)** is a secondary pollutant, formed from daytime reactions of NO_x and volatile organic compounds (VOCs) in the presence of sunlight. VOCs, which are a subset of hydrocarbons (HC) and have no NAAQS, are released in industrial processes and from evaporation of gasoline and solvents. Sources of NO_x are discussed above.
- **Particulate matter** (PM) comprises very small particles of dirt, dust, soot, or liquid droplets called aerosols. The NAAQS for PM is segregated by sizes (i.e., less than 10 and less than 2.5 microns as PM_{10} and $PM_{2.5}$, respectively). PM is formed as an exhaust product in the internal combustion engine or can be generated from the breakdown and dispersion of other solid materials (e.g., fugitive dust).
- **Sulfur oxides** are primarily composed of sulfur dioxide (SO_2) which is emitted in natural processes and by man-made sources such as combustion of sulfur-containing fuels and sulfuric acid manufacturing.

The NAAQS for these criteria pollutants are subdivided into the Primary Standards (designed to protect human health) and the Secondary Standards (designed to protect the environment and human welfare) and are listed below in Table I-1. Exceedances of these values constitute violations of the NAAQS.

Table I-1 National Ambient Air Quality Standards

Pollutants	Averaging Time	Concentration	Condition of Violation
Ozone (O_3)	8-hour	0.075 ppm	3-year average of the fourth-highest maximum 8-hour average.
Carbon Monoxide (CO)	8-hour	9.0 ppm	No more than once per year.
	1-hour	35 ppm	
Nitrogen Dioxide (NO_2)	Annual Average	0.053 ppm	3-year average of the 98th percentile of the daily maximum 1-hour average.
	1-hour	0.100 ppm	
Sulfur Dioxide (SO_2)	3-hour	5 ppm	3-hour standard: No more than once per year
	1-hour	0.075 ppm	1-hour standard: Three-year average of the 98th percentile.
Particulate Matter (PM_{10})	24-hour	150 $\mu g/m^3$	3-year average of the 98th percentile.
Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Mean	15 $\mu g/m^3$	3-year average of the 98th percentile.
	24-hour	35 $\mu g/m^3$	
Lead (Pb)	Calendar Quarter	0.15 $\mu g/m^3$	Rolling 3-month average not to be exceeded.

Source: U.S. EPA, 2012, http://www.epa.gov/air/criteria.html
Note: ppm - parts per million; $\mu g/m^3$ - micrograms per cubic meter

Sources of Airport Air Emissions

Almost all large metropolitan airports generate air emissions from the following general source categories: aircraft, ground service equipment (GSE), and motor vehicles traveling to, from, and moving about the airport; fuel storage and transfer facilities; a variety of stationary sources (e.g., steam boilers, back-up generators, snow melters, etc.); an assortment of aircraft maintenance activities (e.g., painting, cleaning, repair, etc.); routine airfield, roadway, and building maintenance activities (e.g., painting, cleaning, repair, etc.); and periodic construction activities for new projects or improvements to existing facilities. Table I-2 provides a summary listing of these sources of air emissions, the pollutants, and their characteristics.

Table I-2 Airport-related Sources of Air Emissions

Sources	Emissions	Characteristics
Aircraft	CO NO_2 PM SO_2 VOCs	Exhaust products of fuel combustion that vary depending on aircraft engine type, number of engines, power setting, and period of operation. Emissions are also emitted by an aircraft's auxiliary power unit (APU).
Motor vehicles	CO NO_2 PM SO_2 VOCs	Exhaust products of fuel combustion from patron and employee traffic approaching, departing, and moving about the airport site. Emissions vary depending on vehicle type, distance traveled, operating speed, and ambient conditions.
Ground service equipment	CO NO_2 PM SO_2 VOCs	Exhaust products of fuel combustion from service trucks, tow tugs, belt loaders, and other portable equipment.
Fuel storage and transfer	VOCs	Formed from the evaporation and vapor displacement of fuel from storage tanks and fuel transfer facilities. Emissions vary with fuel usage, type of storage tank, refueling method, fuel type, vapor recovery, climate, and ambient temperature.
Stationary sources	CO NO_2 PM SO_2 VOCs	Exhaust products of fossil fuel combustion from boilers dedicated to indoor heating requirements and emissions from incinerators used for waste reduction. Emissions are generally well controlled with operational techniques and post-burn collection methods. Sources include boilers and hot water generators, emergency generators, incinerators, paint booth and surface coating operations, welding operations, and fire fighting facilities.
Construction Activities	CO NO_2 PM SO_2 VOCs	Construction projects may have associated emissions from dust generated during excavation and land clearing, exhaust emissions from construction equipment and motor vehicles, and evaporative emissions from asphalt paving and painting. The amount of particulate emissions varies with the material type, the amount of area exposed, and meteorology. The construction of airport and airfield improvement projects at airports represents temporary sources of emissions.

Notes: CO - Carbon monoxide; VOC - Volatile organic compounds; PM - Particulate matter; NO_2 - Nitrogen dioxide; SO_2 - Sulfur dioxide.

The U.S. EPA, state, and local air quality agencies maintain outdoor air monitoring networks to measure air quality conditions and gauge compliance with the NAAQS. Based upon the data collected by these agencies, all areas throughout the country are designated by the U.S. EPA with respect to their compliance with the NAAQS. Table I-3 provides the definitions of each of these designations.

Table I-3 Attainment, Nonattainment and Maintenance Areas

Attainment/Nonattainment Designations			
Attainment	**Attainment/Maintenance**	**Nonattainment Area**	**Unclassifiable**
Any area that meets the NAAQS established for all of the criteria air pollutants.	Any area that is in transition from formerly being a nonattainment area to an attainment area (also called Maintenance).	Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) one or more of the NAAQS.	Any area that cannot be classified on the basis of available information as meeting or not meeting the NAAQS.

Source: U.S. EPA

For O_3, CO, PM_{10}, and $PM_{2.5}$, the nonattainment designations are further classified by the severity, or degree, of the violation of the NAAQS. For example, in the case of O_3, these classifications range from highest to lowest as extreme, severe, serious, marginal, and moderate.

The nonattainment designation of an area has a bearing on the emission control measures required and the time periods allotted by which a State Implementation Plan (SIP) must demonstrate attainment of the NAAQS. It is also important to note that the degree of nonattainment determines the thresholds of emissions that are considered to be "*de minimis,*" or levels below (i.e., within) which a formal General Conformity determination is not required.

Finally, the boundaries of nonattainment areas are generally determined based on Core Based Statistical Areas (CBSA) as defined by U.S. census data (air monitoring station locations and contributing emission sources also play a role). However, nonattainment areas for localized pollutants such as lead and CO typically only comprise a partial CBSA or a local "hot-spot". By comparison, regional pollutants such as O_3 can encompass multiple CBSAs and can extend across state lines.

State Implementation Plans (SIP)

For the purposes of this summary explanation of SIPs, it is sufficient to characterize SIPs as the principal instrument by which a state formulates and implements its strategies for bringing nonattainment or maintenance areas into compliance with the NAAQS. In equally broad terms, the SIP contains the necessary emission limitations, control measures and timetables for achieving this objective. Therefore, the SIP development process is delegated to state air quality agencies that may in turn rely on regional, county and local agencies to help prepare emission inventories that include airport-related emissions.

Aircraft Fleet and Operational Data used in EDMS Version 5.1.3

The Federal Aviation Administration (FAA) Emissions Dispersion System (EDMS) is the EPA-preferred and the FAA-required model for conducting airport air quality analyses. The most recent version of EDMS, Version 5.1.3 (EDMS v5.1.3), was used in support of the *2011 Environmental Status and Planning Report* (*2011 ESPR*) air quality analysis.

Table I-4 contains the data that was used in EDMS v5.1.3 to represent actual conditions at Logan Airport in 2011. This data includes aircraft type, engine, landing takeoff cycles (LTOs), and taxi times. The aircraft are divided into four categories: air carrier, cargo, commuter, and GA. Table I-5 contains the projected fleet mix, LTOs, and taxi times for the year 2030.

Table I-4 2011 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft				
Airbus A310-200 Series	CF6-80A3	200	AC SATA	25.17
Airbus A319-100 Series	CFM56-5A4	23	AC ACA	25.17
Airbus A319-100 Series	V2522-A5	100	AC BAW	25.17
Airbus A319-100 Series	CFM56-5A5	4,666	AC DAL	25.17
Airbus A319-100 Series	CFM56-5B5/P	565	AC Frontier	25.17
Airbus A319-100 Series	V2524-A5	1,172	AC Spirit	25.17
Airbus A319-100 Series	V2522-A5	919	AC UAL	25.17
Airbus A319-100 Series	CFM56-5B6/P	7,388	AC USA	25.17
Airbus A319-100 Series	CFM56-5B6/P	800	AC Virgin America	25.17
Airbus A320-200 Series	CFM56-5-A1	39	AC ACA	25.17
Airbus A320-200 Series	V2527-A5	124	AC BAW	25.17
Airbus A320-200 Series	CFM56-5A3	2,523	AC DAL	25.17
Airbus A320-200 Series	V2527-A5	15,647	AC JBU	25.17
Airbus A320-200 Series	V2527-A5	355	AC Spirit	25.17
Airbus A320-200 Series	V2527-A5	2,332	AC UAL	25.17
Airbus A320-200 Series	CFM56-5B4/P	1,956	AC USA	25.17
Airbus A320-200 Series	V2527-A5	713	AC Virgin America	25.17
Airbus A321-100 Series	CFM56-5B3/P	606	AC USA	25.17
Airbus A330-200 Series	CF6-80E1A4 Low emissions	260	AC AZA	25.17
Airbus A330-200 Series	CF6-80E1A2 1862M39	295	AC EIN	25.17
Airbus A330-200 Series	PW4168A Talon II	11	AC SWR	25.17
Airbus A330-300 Series	PW4168A Talon II	369	AC DAL	25.17
Airbus A330-300 Series	PW4168A Talon II	121	AC DLH	25.17
Airbus A330-300 Series	CF6-80E1A4 Standard	270	AC EIN	25.17
Airbus A330-300 Series	Trent 772 Improved traverse	17	AC SWR	25.17
Airbus A330-300 Series	PW4168A Talon II	6	AC USA	25.17
Airbus A340-300 Series	CFM56-5C2	244	AC AFR	25.17
Airbus A340-300 Series	CFM56-5C4/P SAC	211	AC DLH	25.17
Airbus A340-300 Series	CFM56-5C4/P SAC	212	AC Iberia	25.17
Airbus A340-300 Series	CFM56-5C4	334	AC SWR	25.17
Airbus A340-300 Series	CFM56-5C4/P SAC	51	AC VIR	25.17
Airbus A340-600 Series	Trent 556-61 Phase 5 tiled	267	AC DLH	25.17
Airbus A340-600 Series	Trent 556-61 Phase 5 tiled	10	AC Iberia	25.17
Airbus A340-600 Series	Trent 556-61 Phase 5 tiled	292	AC VIR	25.17
Boeing 717-200 Series	BR700-715A1-30	4,533	AC TRS	25.17
Boeing 737-300 Series	CFM56-3-B1	594	AC SWA	25.17
Boeing 737-300 Series	CFM56-3-B1	67	AC USA	25.17
Boeing 737-400 Series	CFM56-3B-2	5	AC Empresa Peru (charter)	25.17
Boeing 737-400 Series	CFM56-3B-2	18	AC Miami Air (charter)	25.17
Boeing 737-400 Series	CFM56-3C-1	40	AC Other Charter (domestic)	25.17
Boeing 737-400 Series	CFM56-3B-2	990	AC USA	25.17
Boeing 737-500 Series	CFM56-3C-1	1,431	AC COA	25.17
Boeing 737-500 Series	CFM56-3-B1	215	AC SWA	25.17
Boeing 737-700 Series	CFM56-7B22	12	AC Aeromexico (charter)	25.17
Boeing 737-700 Series	CFM56-7B22	50	AC Astraeus	25.17

Table I-4 2011 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft (Cont'd.)				
Boeing 737-700 Series	CFM56-7B24	492	AC COA	25.17
Boeing 737-700 Series	CFM56-7B26/2	1	AC DAL	25.17
Boeing 737-700 Series	CFM56-7B22	18	AC Empresa Peru (charter)	25.17
Boeing 737-700 Series	CFM56-7B22	109	AC Sun Country	25.17
Boeing 737-700 Series	CFM56-7B24	7,897	AC SWA	25.17
Boeing 737-700 Series	CFM56-7B22	1,902	AC TRS	25.17
Boeing 737-800 Series	CFM56-7B26	4,651	AC AAL	25.17
Boeing 737-800 Series	CFM56-7B27	4	AC Aeromexico (charter)	25.17
Boeing 737-800 Series	CFM56-7B26	872	AC ASA	25.17
Boeing 737-800 Series	CFM56-7B26	2,545	AC COA	25.17
Boeing 737-800 Series	CFM56-7B26	1,483	AC DAL	25.17
Boeing 737-800 Series	CFM56-7B26	70	AC Miami Air (charter)	25.17
Boeing 737-800 Series	CFM56-7B26	147	AC Sun Country	25.17
Boeing 737-900 Series	CFM56-7B26	6	AC ASA	25.17
Boeing 737-900 Series	CFM56-7B27	416	AC COA	25.17
Boeing 747-400 Series	PW4056 Reduced emissions	261	AC AFR	25.17
Boeing 747-400 Series	RB211-524H	477	AC BAW	25.17
Boeing 747-400 Series	CF6-80C2B1F 1862M39	267	AC DLH	25.17
Boeing 747-400 Series	CF6-80C2B1F 1862M39	17	AC VIR	25.17
Boeing 757-200 Series	RB211-535E4B Phase 5	5,689	AC AAL	25.17
Boeing 757-200 Series	RB211-535E4	24	AC COA	25.17
Boeing 757-200 Series	PW2037	3,004	AC DAL	25.17
Boeing 757-200 Series	PW2037	7	AC Empresa Peru (charter)	25.17
Boeing 757-200 Series	RB211-535E4	464	AC ICE	25.17
Boeing 757-200 Series	PW2037	118	AC TACV-Cabo Verde	25.17
Boeing 757-200 Series	PW2037	4,379	AC UAL	25.17
Boeing 757-200 Series	RB211-535E4	10	AC USA	25.17
Boeing 757-300 Series	RB211-535E4B Phase 5	1	AC COA	25.17
Boeing 757-300 Series	PW2040	4	AC DAL	25.17
Boeing 767-200 Series	CF6-80A1	8	AC AAL	25.17
Boeing 767-200 Series	CF6-80C2B4F 1862M39	1	AC COA	25.17
Boeing 767-200 Series	CF6-80C2B2 1862M39	7	AC USA	25.17
Boeing 767-300 Series	CF6-80C2B6 1862M39	123	AC AAL	25.17
Boeing 767-300 Series	CF6-80C2B6 1862M39	39	AC AZA	25.17
Boeing 767-300 Series	RB211-524H	6	AC BAW	25.17
Boeing 767-300 Series	CF6-80A2	279	AC DAL	25.17
Boeing 767-300 Series	PW4060 Reduced emissions	44	AC UAL	25.17
Boeing 767-400 ER	CF6-80C2B8FA 1862M39	2	AC COA	25.17
Boeing 767-400 ER	CF6-80C2B7F 1862M39	357	AC DAL	25.17
Boeing 777-200 Series	Trent 892	8	AC AAL	25.17
Boeing 777-200 Series	GE90-90B DAC I	1	AC AFR	25.17
Boeing 777-200 Series	GE90-94B DAC II	3	AC AZA	25.17
Boeing 777-200 Series	GE90-90B DAC I	374	AC BAW	25.17
Boeing 777-200 Series	GE90-92B DAC I	5	AC COA	25.17
Boeing 777-200 Series	Trent 892	1	AC DAL	25.17
Boeing 777-200 Series	GE90-90B DAC II	26	AC Other Charter (international)	25.17
Boeing 777-200 Series	PW4077	2	AC UAL	25.17
Boeing DC-9-50 Series	JT8D-17 Reduced emissions	385	AC DAL	25.17
Boeing MD-82	JT8D-217 Environmental Kit	42	AC AAL	25.17
Boeing MD-83	JT8D-219 Environmental Kit	25	AC AAL	25.17
Boeing MD-83	JT8D-219 Environmental Kit	60	AC Allegiant Air (charter)	25.17

Table I-4 2011 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft (Cont'd.)				
Boeing MD-83	JT8D-219 Environmental Kit	16	AC USA Jet (charter)	25.17
Boeing MD-88	JT8D-219 Environmental Kit	5	AC Allegiant Air (charter)	25.17
Boeing MD-88	JT8D-219 Environmental Kit	1,125	AC DAL	25.17
Boeing MD-90	V2525-D5	158	AC DAL	25.17
Bombardier Challenger 300	AE3007A1 Type 2	13	AC Business Jet Solutions (charter)	25.17
Bombardier Challenger 300	AE3007A1 Type 2	8	AC Key Air (charter)	25.17
Bombardier Challenger 600	ALF 502L-2	4	AC Business Jet Solutions (charter)	25.17
Bombardier Challenger 600	ALF 502L-2	6	AC Jet Charter (charter)	25.17
Bombardier Learjet 35	TFE731-2-2B	2	AC Jet Charter (charter)	25.17
Bombardier Learjet 40	TFE731-2-2B	7	AC Business Jet Solutions (charter)	25.17
Bombardier Learjet 45	TFE731-2-2B	4	AC Business Jet Solutions (charter)	25.17
Bombardier Learjet 60	TFE731-2/2A	7	AC Business Jet Solutions (charter)	25.17
Bombardier Learjet 60	TFE731-2/2A	2	AC Jet Charter (charter)	25.17
Dassault Falcon 2000	PW308C Annular	5	AC Jet Charter (charter)	25.17
Embraer ERJ170	CF34-8E5A1 LEC	1,686	AC ACA	25.17
Embraer ERJ190	CF34-10E	334	AC ACA	25.17
Embraer ERJ190	CF34-10E	16,317	AC JBU	25.17
Embraer ERJ190	CF34-10E	7,205	AC USA	25.17
Gulfstream G400	TAY Mk611-8	6	AC Key Air (charter)	25.17
Gulfstream G500	BR700-710A1-10	5	AC ACM Aviation (charter)	25.17
Israel IAI-1126 Galaxy	PW306A Annular	10	AC ACM Aviation (charter)	25.17
Raytheon Hawker 800	TFE731-3	5	AC ACM Aviation (charter)	25.17
Total Air Carrier Aircraft LTOs		**115,116**		
Cargo Aircraft				
Airbus A300F4-600 Series	CF6-80C2A5F 1862M39	231	Cargo FDX	25.17
Airbus A300F4-600 Series	PW4158 Reduced smoke	542	Cargo UPS	25.17
Airbus A310-200 Series	JT9D-7R4E, -7R4E1	13	Cargo FDX	25.17
Boeing 727-200 Series	JT8D-15 Reduced emissions	113	Cargo Capital Cargo International	25.17
Boeing 727-200 Series	JT8D-15 Reduced emissions	208	Cargo FDX	25.17
Boeing 757-200 Series	RB211-535E4	25	Cargo FDX	25.17
Boeing 757-200 Series	PW2040	36	Cargo UPS	25.17
Boeing 767-300 ER	CF6-80C2B6F	92	Cargo UPS	25.17
Boeing DC-10-10 Series	CF6-6D	956	Cargo FDX	25.17
Boeing DC-8 Series 70	CFM56-2-C5	33	Cargo Air Transport International	25.17
Boeing DC-8 Series 70	CFM56-2-C5	246	Cargo DHL Airways	25.17
Boeing MD-11	CF6-80C2D1F 1862M39	52	Cargo FDX	25.17
Bombardier Challenger 600	CF34-3B	11	Cargo FDX	25.17
Bombardier Learjet 25	CJ610-6	1	Cargo Royal Air Freight	25.17
Bombardier Learjet 35	TFE731-2-2B	2	Cargo Royal Air Freight	25.17
Cessna 208 Caravan	PT6A-114	45	Cargo AirNet	25.17
Cessna 310	TIO-540-J2B2	2	Cargo Royal Air Freight	25.17
Piper PA-31 Navajo	TIO-540-J2B2	277	Cargo AirNet	25.17
Raytheon Beech Baron 58	TIO-540-J2B2	47	Cargo AirNet	25.17
Total Cargo Aircraft LTOs		**2,932**		

Table I-4 2011 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Commuter Aircraft				
Bombardier CRJ-100	CF34-3A1 LEC II	684	Comm Delta (Comair)	25.17
Bombardier CRJ-100	CF34-3B	1,569	Comm JZA	25.17
Bombardier CRJ-200	CF34-3B	6	Comm Atlantic Southeast Airlines	25.17
Bombardier CRJ-200	CF34-3B	43	Comm Delta (Comair)	25.17
Bombardier CRJ-200	CF34-3B	753	Comm Delta (Pinnacle)	25.17
Bombardier CRJ-200	CF34-3B	1,505	Comm JZA	25.17
Bombardier CRJ-200	CF34-3B	3,249	Comm US Airways Express	25.17
Bombardier CRJ-700	CF34-8C1	2,370	Comm Atlantic Southeast Airlines	25.17
Bombardier CRJ-700	CF34-8C1	1,300	Comm Delta (Comair)	25.17
Bombardier CRJ-700	CF34-8C1	771	Comm EGF	25.17
Bombardier CRJ-700	CF34-8C1	75	Comm Horizon	25.17
Bombardier CRJ-700	CF34-8C1	130	Comm Mesa	25.17
Bombardier CRJ-900	CF34-8C5 LEC	168	Comm Atlantic Southeast Airlines	25.17
Bombardier CRJ-900	CF34-8C5 LEC	1,827	Comm Delta (Comair)	25.17
Bombardier CRJ-900	CF34-8C5 LEC	1,558	Comm Delta (Mesaba)	25.17
Bombardier CRJ-900	CF34-8C5 LEC	127	Comm JZA	25.17
Bombardier de Havilland Dash 8 Q100	PW120A	147	Comm JZA	25.17
Bombardier de Havilland Dash 8 Q100	PW120A	665	Comm US Airways (Piedmont)	25.17
Bombardier de Havilland Dash 8 Q300	PW123	53	Comm JZA	25.17
Bombardier de Havilland Dash 8 Q400	PW150A	595	Comm Colgan	25.17
Bombardier de Havilland Dash 8 Q400	PW150A	1,571	Comm Porter Airlines	25.17
Cessna 402	TIO-540-J2B2	16,439	Comm Hyannis Air Service	25.17
Cessna 402	TIO-540-J2B2	825	Comm Island Airlines	25.17
Cessna 402	TIO-540-J2B2	618	Comm Twin Cities Air Service	25.17
Dassault Falcon 2000	PW308C Annular	91	Comm Hyannis Air Service	25.17
Embraer ERJ135	AE3007A1/3 Type 3	3,662	Comm EGF	25.17
Embraer ERJ145	AE3007A1E Type 3	1,474	Comm Chautaugua	25.17
Embraer ERJ145	AE3007A1E Type 3	619	Comm Continental Express	25.17
Embraer ERJ145	AE3007A1E Type 3	4	Comm EGF	25.17
Embraer ERJ145	AE3007A1E Type 3	303	Comm Trans States	25.17
Embraer ERJ170	CF34-8E5 LEC	788	Comm Delta (Compass Airlines)	25.17
Embraer ERJ170	CF34-8E5 LEC	1,634	Comm Republic Airlines	25.17
Embraer ERJ170	CF34-8E5 LEC	1,974	Comm Shuttle America	25.17
Embraer ERJ190	CF34-10E6 SAC	564	Comm Republic Airlines	25.17
Gulfstream G400	TAY Mk611-8	8	Comm Colgan	25.17
Saab 340-B-Plus	CT7-9B	4,147	Comm Colgan	25.17
Total Commuter Aircraft LTOs		**52,316**		
General Aviation Aircraft				
Bombardier Challenger 300	AE3007A1 Type 2	338	GA	25.17
Bombardier Challenger 300	AE3007A1 Type 2	155	GA Bombardier Business Jet	25.17
Bombardier Challenger 600	CF34-3B	714	GA	25.17
Bombardier Challenger 600	ALF 502L-2	48	GA Bombardier Business Jet	25.17
Bombardier Challenger 600	ALF 502L-2	35	GA Executive Jet	25.17
Bombardier Learjet 35	TFE731-2-2B	278	GA	25.17
Bombardier Learjet 40	TFE731-2-2B	102	GA Bombardier Business Jet	25.17
Bombardier Learjet 45	TFE731-2-2B	288	GA	25.17
Bombardier Learjet 45	TFE731-2-2B	41	GA Bombardier Business Jet	25.17
Bombardier Learjet 60	TFE731-2/2A	297	GA	25.17
Bombardier Learjet 60	TFE731-2/2A	50	GA Bombardier Business Jet	25.17

Table I-4 2011 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
General Aviation Aircraft (Cont'd.)				
Cessna 172 Skyhawk	TSIO-360C	23	GA Angel Flight	25.17
Cessna 182	IO-360-B	73	GA Angel Flight	25.17
Cessna 208 Caravan	PT6A-114	242	GA Wiggins	25.17
Cessna 402	TIO-540-J2B2	343	GA Hyannis Air Service	25.17
Cessna 525 CitationJet	JT15D-1 series	120	GA Citationshares	25.17
Cessna 550 Citation II	JT15D-4 series	348	GA	25.17
Cessna 560 Citation Excel	JT15D-5, -5A, -5B	447	GA	25.17
Cessna 560 Citation Excel	JT15D-5, -5A, -5B	125	GA Citationshares	25.17
Cessna 560 Citation Excel	JT15D-5, -5A, -5B	29	GA Executive Jet	25.17
Cessna 560 Citation V	JT15D-5, -5A, -5B	316	GA	25.17
Cessna 560 Citation V	JT15D-5, -5A, -5B	216	GA Netjets Aviation	25.17
Cessna 560 Citation XLS	JT15D-5, -5A, -5B	95	GA General Aviation Flying Service	25.17
Cessna 560 Citation XLS	JT15D-5, -5A, -5B	760	GA Netjets Aviation	25.17
Cessna 680 Citation Sovereign	PW308C Annular	72	GA Citationshares	25.17
Cessna 680 Citation Sovereign	PW308C Annular	41	GA Executive Jet	25.17
Cessna 680 Citation Sovereign	PW308C Annular	346	GA Netjets Aviation	25.17
Cessna 750 Citation X	AE3007C Type 1	264	GA	25.17
Cessna 750 Citation X	AE3007C Type 1	16	GA Citationshares	25.17
Cessna 750 Citation X	AE3007C Type 1	19	GA Executive Jet	25.17
Cessna 750 Citation X	AE3007C Type 1	47	GA Flight Options	25.17
Cessna 750 Citation X	AE3007C Type 1	484	GA Netjets Aviation	25.17
Cirrus SR22	TIO-540-J2B2	66	GA Angel Flight	25.17
Dassault Falcon 2000	PW308C Annular	349	GA	25.17
Dassault Falcon 2000	PW308C Annular	17	GA Executive Jet	25.17
Dassault Falcon 2000	PW308C Annular	17	GA General Aviation Flying Service	25.17
Dassault Falcon 2000	PW308C Annular	183	GA Netjets Aviation	25.17
Dassault Falcon 50	TFE731-3	243	GA	25.17
Dassault Falcon 50	TFE731-3	14	GA Executive Jet	25.17
Dassault Falcon 900	TFE731-3	326	GA	25.17
Dassault Falcon 900	TFE731-3	14	GA Executive Jet	25.17
Embraer ERJ135	AE3007A1/3 Type 3	31	GA Flight Options	25.17
Gulfstream G400	TAY Mk611-8	740	GA	25.17
Gulfstream G400	TAY Mk611-8	68	GA Executive Jet	25.17
Gulfstream G400	TAY Mk611-8	27	GA General Aviation Flying Service	25.17
Gulfstream G400	TAY Mk611-8	143	GA Netjets Aviation	25.17
Gulfstream G500	BR700-710A1-10	444	GA	25.17
Gulfstream G500	BR700-710A1-10	33	GA Executive Jet	25.17
Gulfstream G500	BR700-710A1-10	47	GA Netjets Aviation	25.17
Israel IAI-1126 Galaxy	PW306A Annular	201	GA Netjets Aviation	25.17
Mooney M20-K	TSIO-360C	51	GA Angel Flight	25.17
Piaggio P.180 Avanti	PT6A-66	270	GA Wanair	25.17
Pilatus PC-12	PT6A-67B	939	GA	25.17
Pilatus PC-12	PT6A-67B	42	GA Netjets Aviation	25.17
Piper PA-32 Cherokee Six	TIO-540-J2B2	60	GA Angel Flight	25.17
Raytheon Beech 99	PT6A-36	4	GA Wiggins	25.17
Raytheon Beech Baron 58	TIO-540-J2B2	217	GA	25.17
Raytheon Beech Baron 58	TIO-540-J2B2	58	GA Angel Flight	25.17
Raytheon Beech Bonanza 36	TIO-540-J2B2	96	GA Angel Flight	25.17
Raytheon Beechjet 400	JT15D-5, -5A, -5B	838	GA	25.17
Raytheon Beechjet 400	JT15D-5, -5A, -5B	148	GA Flight Options	25.17
Raytheon Beechjet 400	JT15D-5, -5A, -5B	95	GA Netjets Aviation	25.17

Table I-4 2011 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
General Aviation Aircraft (Cont'd.)				
Raytheon Hawker 800	TFE731-3	937	GA	25.17
Raytheon Hawker 800	TFE731-3	19	GA Executive Jet	25.17
Raytheon Hawker 800	TFE731-3	44	GA Flight Options	25.17
Raytheon Hawker 800	TFE731-3	32	GA General Aviation Flying Service	25.17
Raytheon Hawker 800	TFE731-3	249	GA Netjets Aviation	25.17
Raytheon Super King Air 200	PT6A-42	258	GA	25.17
Rockwell Commander 700	IO-360-B	38	GA Angel Flight	25.17
Total General Aviation Aircraft LTOs		**14,130**		
Total Fleet LTOs		**184,494**		

Source: KBE and Massport.

Notes: Due to rounding of the operations (1 LTO = 2 Operations) there may be some differences (+/-) between the values reported here and those reported in *Chapter 2, Activity Levels.*
Aircraft taxi times are based on Logan Airport data obtained from the FAA Aviation System Performance Metrics (ASPM) database for 2011.

Table I-5 2030 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft				
Airbus A319-100 Series	V2522-A5	82	AC	20.02
Airbus A319-100 Series	CFM56-5B6/P	19,495	AC	20.02
Airbus A320-200 Series	V2527-A5	33,656	AC	20.02
Airbus A321-100 Series	CFM56-5B3/P	2,591	AC	20.02
Airbus A330-200 Series	CF6-80E1A2 1862M39	335	AC	20.02
Airbus A330-300 Series	PW4168A Talon II	8,205	AC	20.02
Airbus A340-300 Series	CFM56-5C4	268	AC	20.02
Airbus A340-600 Series	Trent 556-61 Phase 5 tiled	402	AC	20.02
Boeing 717-200 Series	BR700-715A1-30	3,119	AC	20.02
Boeing 737-400 Series	CFM56-3B-2	75	AC	20.02
Boeing 737-700 Series	CFM56-7B22	34	AC	20.02
Boeing 737-700 Series	CFM56-7B24	19,494	AC	20.02
Boeing 737-800 Series	CFM56-7B26	34,187	AC	20.02
Boeing 737-800 Series	CFM56-7B26	221	AC	20.02
Boeing 737-900 Series	CFM56-7B27	6,211	AC	20.02
Boeing 747-400 Series	RB211-524H	335	AC	20.02
Boeing 757-200 Series	RB211-535E4B Phase 5	634	AC	20.02
Boeing 757-200 Series	PW2037	76	AC	20.02
Boeing 767-300 Series	CF6-80C2B6 1862M39	1,219	AC	20.02
Boeing 767-300 Series	CF6-80A2	21	AC	20.02
Boeing 767-400 ER	CF6-80C2B7F 1862M39	216	AC	20.02
Boeing 777-300 Series	GE90-90B DAC I	1,091	AC	20.02
Boeing MD-83	JT8D-219 Environmental Kit	102	AC	20.02
Embraer ERJ190	CF34-10E	24,292	AC	20.02
Total Air Carrier Aircraft LTOs		**156,361**		
Cargo Aircraft				
Airbus A300F4-600 Series	PW4158 Reduced smoke	1,233	Cargo	20.02
Boeing 757-200 Series	PW2040	1,016	Cargo	20.02
Boeing 767-300 ER	CF6-80C2B6F	150	Cargo	20.02
Boeing MD-11	CF6-80C2D1F 1862M39	1,267	Cargo	20.02
Cessna 208 Caravan	PT6A-114	152	Cargo	20.02
Total Cargo Aircraft LTOs		**3,818**		
Commuter Aircraft				
Bombardier CRJ-200	CF34-3B	6,469	Comm	20.02
Bombardier CRJ-700	CF34-8C1	5,101	Comm	20.02
Bombardier CRJ-900	CF34-8C5 LEC	5,144	Comm	20.02
Bombardier de Havilland Dash 8 Q100	PW120A	786	Comm	20.02
Bombardier de Havilland Dash 8 Q300	PW123	786	Comm	20.02
Bombardier de Havilland Dash 8 Q400	PW150A	8,747	Comm	20.02
Cessna 402	TIO-540-J2B2	17,997	Comm	20.02
Embraer ERJ135	AE3007A1/3 Type 3	1,247	Comm	20.02
Embraer ERJ145	AE3007A1E Type 3	1,032	Comm	20.02
Embraer ERJ170	CF34-8E5 LEC	13,748	Comm	20.02
Saab 340-B-Plus	CT7-9B	2,677	Comm	20.02
Total Commuter Aircraft LTOs		**63,734**		

Table I-5 2030 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
General Aviation Aircraft				
Bombardier Challenger 300	AE3007A1 Type 2	429	GA	20.02
Bombardier Challenger 600	CF34-3B	645	GA	20.02
Bombardier Global Express	BR700-710A2-20	219	GA	20.02
Bombardier Learjet 35	TFE731-2-2B	212	GA	20.02
Bombardier Learjet 40	TFE731-2-2B	123	GA	20.02
Bombardier Learjet 45	TFE731-2-2B	265	GA	20.02
Bombardier Learjet 60	TFE731-2/2A	282	GA	20.02
Cessna 182	IO-360-B	92	GA	20.02
Cessna 208 Caravan	PT6A-114	304	GA	20.02
Cessna 525 CitationJet	JT15D-1 series	205	GA	20.02
Cessna 550 Citation II	JT15D-4 series	260	GA	20.02
Cessna 560 Citation Excel	JT15D-5, -5A, -5B	470	GA	20.02
Cessna 560 Citation XLS	JT15D-5, -5A, -5B	1,361	GA	20.02
Cessna 650 Citation III	TFE731-3	89	GA	20.02
Cessna 680 Citation Sovereign	PW308C Annular	602	GA	20.02
Cessna 750 Citation X	AE3007C Type 1	813	GA	20.02
Cirrus SR22	TIO-540-J2B2	171	GA	20.02
Dassault Falcon 2000	PW308C Annular	492	GA	20.02
Dassault Falcon 50	TFE731-3	194	GA	20.02
Dassault Falcon 900	TFE731-3	258	GA	20.02
Embraer ERJ135	AE3007A1/3 Type 3	89	GA	20.02
Gulfstream G150	TFE731-3	107	GA	20.02
Gulfstream G400	TAY Mk611-8	801	GA	20.02
Gulfstream G500	BR700-710A1-10	411	GA	20.02
Israel IAI-1126 Galaxy	PW306A Annular	388	GA	20.02
Piaggio P.180 Avanti	PT6A-66	344	GA	20.02
Pilatus PC-12	PT6A-67B	754	GA	20.02
Piper PA-32 Cherokee Six	TIO-540-J2B2	71	GA	20.02
Piper PA-34 Seneca	IO-360-B	67	GA	20.02
Raytheon Beech 1900-C	PT6A-67D	79	GA	20.02
Raytheon Beech Baron 58	TIO-540-J2B2	341	GA	20.02
Raytheon Beech Bonanza 36	TIO-540-J2B2	82	GA	20.02
Raytheon Beechjet 400	JT15D-5, -5A, -5B	868	GA	20.02
Raytheon Hawker 4000 Horizon	PW308A Annular	75	GA	20.02
Raytheon Hawker 800	TFE731-3	1,071	GA	20.02
Raytheon Super King Air 200	PT6A-42	194	GA	20.02
Raytheon Super King Air 300	PT6A-60A	226	GA	20.02
Total General Aviation Aircraft LTOs		**13,454**		
Total Fleet LTOs		**237,367**		

Source: KBE and Massport.
Notes: Due to rounding of the operations (1 LTO = 2 Operations) there may be some differences (+/-) between the values reported here and those reported in *Chapter 2, Activity Levels.* Aircraft taxi times are based on the Total Airspace and Airport Modeler (TAAM).

Ground Service Equipment/Alternative Fuels Conversion

For the 2011 analyses, GSE emissions were calculated using EDMS emission factors which are based on the EPA NONROAD2005 model in combination with the 2012 GSE time-in-mode survey and the GSE fuel types obtained from the Logan Airport Vehicle Aerodrome Permit Application. In this way, the most up-to-date GSE fleet operational, conversion and emissions characteristics are used.

Table I-6 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day)

Year	Pollutant	Percent Reduction	Calculated Emissions without Reduction	Reduction from AFVs	Calculated Emissions with Reduction
2000	Volatile Organic Compounds (VOCs)	13.72%	178	24	154
	Oxides of Nitrogen (NO_x)	9.87%	369	36	333
	Carbon Monoxide (CO)	12.88%	6,124	789	5,335
2001	VOCs	13.72%	166	23	143
	NO_x	9.87%	338	33	305
	CO	12.88%	5,960	768	5,193
2002	VOCs	13.6%	286	39	247
	NO_x	8.0%	350	28	322
	CO	16.3%	6,174	1,004	5,170
2003	VOCs	13.8%	263	36	227
	NO_x	8.0%	316	25	291
	CO	16.4%	5,692	934	4,758
2004	VOCs	11.9%	212	25	187
	NO_x	6.6%	357	24	333
	CO	15.4%	4,236	650	3,586
2005	VOCs	12.2%	203	25	178
	NO_x	6.9%	335	23	312
	CO	15.4%	4,175	643	3,531
	$PM_{10}/PM_{2.5}$	9.9%	11	1	10
2006	VOCs	10.7%	86	9	77
	NO_x	7.5%	324	24	300
	CO	13.8%	1,841	255	1,586
	$PM_{10}/PM_{2.5}$	10.8%	10	1	9
2007	VOCs	8.2%	85	7	78
	NO_x	5.1%	315	16	299
	CO	10.4%	2,124	220	1,904
	$PM_{10}/PM_{2.5}$	5.9%	10	<1	10
2008	VOCs	8.3%	72	6	66
	NO_x	4.8%	270	13	257
	CO	10.2%	1,792	183	1,609
	$PM_{10}/PM_{2.5}$	5.6%	16	<1	15
2009	VOCs	8.2%	61	5	56
	NO_x	4.8%	230	11	219
	CO	10.0%	1,516	152	1364
	$PM_{10}/PM_{2.5}$	3.5%	14	<1	14

Table I-6 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day) (Continued)

Year	Pollutant	Percent Reduction	Calculated Emissions without Reduction	Reduction from AFVs	Calculated Emissions with Reduction
2010	VOCs	7.5%	53	4	49
	NO_x	3.9%	206	8	198
	CO	8.5%	1,335	113	1,222
	$PM_{10}/PM_{2.5}$	2.5%	13	<1	13
2011	VOCs	13.2%	38	5	33
	NO_x	7.5%	188	14	173
	CO	16.7%	834	139	694
	$PM_{10}/PM_{2.5}$	5.5%	14	1	13

Source: KBE and Massport.
Notes: 2000 and 2001 analyses used EDMS v4.03. 2002 and 2003 analyses used EDMS v4.11, which used updated emission factors from the NONROAD2002 Model. 2004 analyses used EDMS v4.21, which again used emission factors from the EPA NONROAD2002 Model. 2005 analysis used EDMS v4.5, which used emission factors from the EPA NONROAD2002 Model. 2006 analysis used EDMS v5.0.1, which used emission factors from the EPA NONROAD2005 Model. 2007 analysis used EDMS v5.0.2, which used emission factors from the EPA NONROAD2005 Model. 2008 analysis used EDMS v5.1, which used emission factors from the EPA NONROAD2005 Model. 2009 analysis used EDMS v5.1.2, which used emission factors from the EPA NONROAD2005 Model. 2010 and 2011 analysis used EDMS v5.1.3, which used emission factors from the EPA NONROAD2005 Model.

Motor Vehicle Emissions

The same methods used in the *2010 EDR* were also employed to calculate motor vehicle emissions in this *2011 ESPR*. In the *2011 ESPR*, the resultant emission factors were multiplied by average daily vehicle miles to calculate daily emissions. The on-airport traffic data are summarized in the vehicle miles traveled (VMT) analyses of *Appendix G, Ground Access.* Due to the new roadway configuration of the Ted Williams Tunnel, through-traffic no longer traverses Airport property. Therefore, as of 2003, emissions from these vehicles are no longer included as part of the Logan Airport emissions inventory. Further, MOBILE6.2.03 was used to obtain vehicle emissions at idle to estimate parking and curbside motor vehicle emissions.[1] Idling emissions are determined for a unit of time and multiplied by total idling time to reach the associated emissions. The input and output files of MOBILE6.2.03 for 2011 are included as Tables I-7 and I-8. The input and output files of MOBILE6.2.03 for 2030 are included as Tables I-9 and I-10.

1 Idle emissions factors in grams per hour are determined by multiplying the emissions factors at 2.5 miles per hour by 2.5, in accordance with EPA guidance (*MOBILE6 Refers to Mobile5 User Information Sheet #5* EPA, July 30, 1993).

Table I-7 MOBILE6.2.03 Input File for 2011

```
* Calendar Year 2011 Generic MOBILE6 input file for Mesoscale Build/No-Build Analyses
* Filename MA11_ALL.INP created by Craig Woleader, MADEP 617-348-4046, craig.woleader@state.ma.us and Marc Bennett, MADEP 617-292-5597,
marc.bennett@state.ma.us
* revised 12/2/05 to include actual diesel rebuild effects
* revised 12/17/08 to include new IM program for 2011
* revised 6/21/12 by Wayne Arner, KBE, for specific speeds
*
***************  Header Section  ***************
MOBILE6 INPUT FILE
*
PARTICULATES       :
POLLUTANTS         : HC CO NOX CO2
DATABASE OUTPUT    :
WITH FIELDNAMES    :
AGGREGATED OUTPUT  :
EMISSIONS TABLE    : MA11_MES.tb1 REPLACE
REPORT FILE        : MA11_MES.out REPLACE
*
RUN DATA
***************  Run Section #1  ***************
> *** Summer 2011 ***

* Pollutant output format
EXPRESS HC AS VOC  :
EXPAND BUS EFS     :

* Mass. specific user inputs -- require external data file
REG DIST           : 2005_REG.D
I/M DESC FILE      : 09NEWIM.D

* Set Diesel Rebuild effects to 10% as per EPA
REBUILD EFFECTS    : 0.10

STAGE II REFUELING :
91 3 84. 84.

* Inputs for LEV II
94+ LDG IMP        : MA_LEV2.D
T2 EXH PHASE-IN    : LEV2EXH.D
T2 EVAP PHASE-IN   : LEV2EVAP.D
T2 CERT            : LEV2CERT.D

* Meteorological inputs
MIN/MAX TEMP       : 70.4 93.7

* Fuel inputs
FUEL RVP           : 6.8
FUEL PROGRAM       : 2 N

DIESEL FRACTIONS   :
0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.003  0.003
0.002  0.002  0.002  0.002  0.001  0.001  0.001  0.000  0.001  0.001
0.003  0.001  0.002  0.000  0.015
0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001
0.001  0.001  0.001  0.000  0.001  0.001  0.001  0.001  0.001  0.001
0.002  0.002  0.003  0.003  0.006
0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001
0.001  0.001  0.001  0.000  0.001  0.001  0.001  0.001  0.001  0.001
0.002  0.002  0.003  0.003  0.006
0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005
0.005  0.005  0.006  0.005  0.012  0.012  0.017  0.015  0.014  0.016
0.017  0.014  0.018  0.016  0.021
0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005
0.005  0.005  0.006  0.005  0.012  0.012  0.017  0.015  0.014  0.016
0.017  0.014  0.018  0.016  0.021
0.176  0.176  0.176  0.176  0.176  0.176  0.176  0.176  0.170  0.207
```

Table I-7 MOBILE6.2.03 Input File for 2011

```
0.202   0.206   0.243   0.176   0.285   0.267   0.212   0.255   0.295   0.249
0.251   0.188   0.175   0.182   0.186
0.385   0.385   0.385   0.385   0.385   0.385   0.385   0.385   0.407   0.433
0.467   0.464   0.480   0.375   0.472   0.480   0.366   0.400   0.344   0.285
0.333   0.314   0.253   0.208   0.197
0.674   0.674   0.674   0.674   0.674   0.674   0.674   0.674   0.634   0.664
0.719   0.717   0.744   0.715   0.565   0.810   0.803   0.644   0.654   0.605
0.525   0.389   0.356   0.376   0.108
0.830   0.830   0.830   0.830   0.830   0.830   0.830   0.830   0.845   0.860
0.840   0.819   0.813   0.610   0.686   0.570   0.733   0.607   0.729   0.685
0.725   0.631   0.350   0.305   0.186
0.884   0.884   0.884   0.884   0.884   0.884   0.884   0.884   0.840   0.887
0.931   0.917   0.914   0.923   0.901   0.908   0.898   0.903   0.876   0.804
0.844   0.782   0.702   0.679   0.554
0.977   0.977   0.977   0.977   0.977   0.977   0.977   0.977   0.972   0.953
0.993   0.992   0.992   0.990   0.981   0.976   0.975   0.959   0.982   0.965
0.963   0.945   0.902   0.875   0.857
0.972   0.972   0.972   0.972   0.972   0.972   0.972   0.972   0.955   0.984
0.995   0.992   0.991   0.995   0.993   0.993   0.995   0.992   0.986   0.995
0.981   0.993   0.971   0.982   0.977
1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000
1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000
1.000   1.000   1.000   1.000   1.000
0.786   0.786   0.786   0.786   0.786   0.786   0.786   0.786   0.917   0.884
0.925   0.968   0.961   0.972   0.985   0.971   0.941   0.905   0.965   0.940
0.907   0.964   0.609   0.880   1.000

***************     Scenario Section     ***************

SCENARIO RECORD    : 2011 Idle Scenario - Summer (multiply g/mi by 2.5 mph to get g/hr)
CALENDAR YEAR      : 2011
EVALUATION MONTH   : 7
PARTICULATE EF     : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE      : 10
DIESEL SULFUR      : 15
AVERAGE SPEED      : 2.5 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD    : 2011 5 mph - Summer
CALENDAR YEAR      : 2011
EVALUATION MONTH   : 7
PARTICULATE EF     : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE      : 10
DIESEL SULFUR      : 15
AVERAGE SPEED      : 5 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD    : 2011 10 mph - Summer
CALENDAR YEAR      : 2011
EVALUATION MONTH   : 7
PARTICULATE EF     : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE      : 10
DIESEL SULFUR      : 15
AVERAGE SPEED      : 10 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD    : 2011 15 mph - Summer
CALENDAR YEAR      : 2011
EVALUATION MONTH   : 7
PARTICULATE EF     : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE      : 10
DIESEL SULFUR      : 15
AVERAGE SPEED      : 15 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD    : 2011 20 mph - Summer
CALENDAR YEAR      : 2011
EVALUATION MONTH   : 7
PARTICULATE EF     : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
```

Table I-7 MOBILE6.2.03 Input File for 2011

```
PARTICLE SIZE      : 10
DIESEL SULFUR      : 15
AVERAGE SPEED      : 20 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD    : 2011 25 mph - Summer
CALENDAR YEAR      : 2011
EVALUATION MONTH   : 7
PARTICULATE EF     : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE      : 10
DIESEL SULFUR      : 15
AVERAGE SPEED      : 25 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD    : 2011 30 mph - Summer
CALENDAR YEAR      : 2011
EVALUATION MONTH   : 7
PARTICULATE EF     : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE      : 10
DIESEL SULFUR      : 15
AVERAGE SPEED      : 30 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD    : 2011 35 mph - Summer
CALENDAR YEAR      : 2011
EVALUATION MONTH   : 7
PARTICULATE EF     : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE      : 10
DIESEL SULFUR      : 15
AVERAGE SPEED      : 35 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD    : 2011 50 mph - Summer
CALENDAR YEAR      : 2011
EVALUATION MONTH   : 7
PARTICULATE EF     : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE      : 10
DIESEL SULFUR      : 15
AVERAGE SPEED      : 50 Arterial 0.0 100.0 0.0 0.0

***************   End of This Run   ***************
END OF RUN
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
*******************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                    *
* Input file: MA11_ALL.INP (file 1, run 1). *
*******************************************************************************
* *** Summer 2011 ***

* Reading Registration Distributions from the following external
* data file: 2005_REG.D
 M 49 Warning:
           1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
          0.998    MYR sum not = 1. (will normalize)
 M 49 Warning:
          0.998    MYR sum not = 1. (will normalize)
 M 49 Warning:
          0.998    MYR sum not = 1. (will normalize)
 M 49 Warning:
           1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
           1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
          0.999    MYR sum not = 1. (will normalize)
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
 M 49 Warning:
          0.998    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
          0.999    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)

* Reading I/M program description records from the following external
* data file: 09NEWIM.D
* 15 Year Exemption Age
* New Annual OBD Exhaust I/M program for Light Duty MY 1996 through 2007 vehicles <=8,500 lb GVWR
* New Annual OBD Exhaust I/M program for Light Duty and Medium duty MY 2008 and later <=14,000 lb GVWR
* New Annual OBD Evap I/M program for Light Duty MY 1996 through 2007 vehicles <=8,500 lb GVWR
* New Annual OBD Evap I/M program for for Light Duty and Medium duty MY 2008 and later <=14,000 lb GVWR
 M601 Comment:
          User has enabled STAGE II REFUELING.

* Reading 94+ LEV IMPLEMENTATION SCHEDULE from the following external
* data file: MA_LEV2.D

 Reading User Supplied Tier2 Exhaust bin phase-in fractions

   Data read from file: LEV2EXH.D

 Reading User Supplied Tier2 EVAP phase-in fractions

   Data read from file: LEV2EVAP.D

 Reading User Supplied Tier2 50K certification standards

   Data read from file: LEV2CERT.D

 M616 Comment:
          User has supplied post-1999 sulfur levels.
 M614 Comment:
          User supplied diesel sale fractions.

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2011 Idle Scenario - Summer (multiply g/mi by 2.5 mph to get g/hr)
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # #

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
```

Table I-8 MOBILE6.2.03 Output Files for 2011

* from the external data file PMDDR2.CSV
M583 Warning:
The user supplied arterial average speed of 2.5
will be used for all hours of the day. 100% of VMT
has been assigned to the arterial/collector roadway
type for all hours of the day and all vehicle types.
*** I/M credits for Tech1&2 vehicles were read from the following external
data file: TECH12.D
M 48 Warning:
there are no sales for vehicle class HDGV8b
HDDV DEFEAT DEVICE EFFECTS ARE PRESENT. THE REBUILD FRACTION IS 0.10.

* Reading Ammonia (NH3) Basic Emission Rates
* from the external data file PMNH3BER.D

* Reading Ammonia (NH3) Sulfur Deterioration Rates
* from the external data file PMNH3SDR.D

LEV phase-in data read from file MA_LEV2.D
Calendar Year: 2011
Month: July
Altitude: Low
Minimum Temperature: 70.4 (F)
Maximum Temperature: 93.7 (F)
Absolute Humidity: 75. grains/lb
Fuel Sulfur Content: 30. ppm

Exhaust I/M Program: Yes
Evap I/M Program: Yes
ATP Program: No
Reformulated Gas: Yes

Vehicle Type:	LDGV	LDGT12	LDGT34	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
GVWR:		<6000	>6000	(All)						
VMT Distribution:	0.3163	0.3987	0.1568		0.0368	0.0002	0.0014	0.0858	0.0038	1.0000
Fuel Economy (mpg):	24.1	18.5	14.2	17.1	9.9	31.6	18.4	7.3	50.0	16.3
Composite Emission Factors (g/mi):										
Composite VOC :	2.982	2.077	2.344	2.152	3.246	0.609	0.539	1.098	12.12	2.400
Composite CO :	14.34	11.47	12.98	11.90	29.49	4.174	1.598	6.583	120.29	13.260
Composite NOX :	0.783	0.675	1.011	0.770	0.978	0.907	0.554	9.134	1.12	1.500
Composite CO2 :	368.1	478.7	623.7	519.6	895.5	322.4	553.9	1401.7	177.4	559.89

Veh. Type:	GasBUS	URBAN	SCHOOL
VMT Mix:	0.0003	0.0009	0.0015
Fuel Economy (mpg):	6.4	4.3	6.2
Composite Emission Factors (g/mi):			
Composite VOC :	2.425	0.931	1.341
Composite CO :	47.72	10.308	6.109
Composite NOX :	1.532	15.483	10.750
Composite CO2 :	1375.1	2342.5	1646.7

* #
* 2011 5 mph - Summer
* File 1, Run 1, Scenario 2.
* #

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

Table I-8 MOBILE6.2.03 Output Files for 2011

```
* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
       The user supplied arterial average speed of  5.0
       will be used for all hours of the day. 100% of VMT
       has been assigned to the arterial/collector roadway
       type for all hours of the day and all vehicle types.
 M 48 Warning:
        there are no sales for vehicle class HDGV8b

 LEV phase-in data read from file MA_LEV2.D
             Calendar Year:  2011
                  Month:  July
                Altitude:  Low
        Minimum Temperature:  70.4 (F)
        Maximum Temperature:  93.7 (F)
         Absolute Humidity:   75. grains/lb
        Fuel Sulfur Content:   30. ppm

        Exhaust I/M Program:  Yes
          Evap I/M Program:  Yes
             ATP Program:  No
          Reformulated Gas:  Yes

    Vehicle Type:    LDGV   LDGT12   LDGT34    LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
         GVWR:              <6000    >6000     (All)
                   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:  0.3163   0.3987   0.1568            0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
 Fuel Economy (mpg):    24.1     18.5     14.2     17.1      9.9     31.6     18.4      7.3     50.0     16.3
 -------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
   Composite VOC :    1.100    0.828    1.005    0.878    1.528    0.549    0.483    0.965     8.36    1.008
   Composite CO  :     8.47     7.28     8.20     7.54    23.56    3.523    1.339    5.374    71.17    8.471
   Composite NOX :    0.663    0.589    0.878    0.670    1.003    0.818    0.499    8.244     1.05    1.331
   Composite CO2 :    368.1    478.7    623.7    519.6    895.5    322.4    553.9   1401.7    177.4   559.89
 -------------------------------------------------------------------------------------------------------------
       Veh. Type:    GasBUS    URBAN   SCHOOL
                   ------   ------   ------
         VMT Mix:    0.0003   0.0009   0.0015
 Fuel Economy (mpg):     6.4      4.3      6.2
-------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
   Composite VOC :    1.455    0.818    1.178
   Composite CO  :    38.13    8.414    4.987
   Composite NOX :    1.572   13.893    9.628
   Composite CO2 :   1375.1   2342.5   1646.7
-------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2011 10 mph - Summer
* File 1, Run 1, Scenario 3.
* # # # # # # # # # # # # # # # # # # # # # # # # #

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 10.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
         there are no sales for vehicle class HDGV8b

 LEV phase-in data read from file MA_LEV2.D
              Calendar Year:  2011
                    Month:  July
                  Altitude:  Low
         Minimum Temperature:  70.4 (F)
         Maximum Temperature:  93.7 (F)
          Absolute Humidity:   75. grains/lb
         Fuel Sulfur Content:   30. ppm

         Exhaust I/M Program:  Yes
           Evap I/M Program:  Yes
              ATP Program:  No
           Reformulated Gas:  Yes

     Vehicle Type:    LDGV   LDGT12   LDGT34    LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
           GVWR:            <6000    >6000    (All)
                     ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:  0.3163   0.3987   0.1568             0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
 Fuel Economy (mpg):    24.1     18.5     14.2     17.1      9.9     31.6     18.4      7.3     50.0     16.3
 ----------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
   Composite VOC :    0.625    0.487    0.604    0.520    0.925    0.455    0.395    0.757     5.51    0.607
   Composite CO  :     5.79     5.28     5.92     5.46    15.68    2.626    0.982    3.705    36.49    5.901
   Composite NOX :    0.513    0.476    0.714    0.543    1.054    0.683    0.416    6.897     1.00    1.099
   Composite CO2 :    368.1    478.7    623.7    519.6    895.5    322.4    553.9   1401.7    177.4   559.89
 ----------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN   SCHOOL
                    ------   ------   ------
         VMT Mix:   0.0003   0.0009   0.0015
 Fuel Economy (mpg):    6.4      4.3      6.2
-----------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
   Composite VOC :    0.957    0.642    0.925
   Composite CO  :    25.37    5.802    3.439
   Composite NOX :    1.652   11.488    7.930
   Composite CO2 :   1375.1   2342.5   1646.7
-----------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2011 15 mph - Summer
* File 1, Run 1, Scenario 4.
* # # # # # # # # # # # # # # # # # # # # # # # # #

* Reading PM Gas Carbon ZML Levels
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 15.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
         there are no sales for vehicle class HDGV8b

 LEV phase-in data read from file MA_LEV2.D
               Calendar Year:  2011
                       Month:  July
                    Altitude:  Low
         Minimum Temperature:  70.4 (F)
         Maximum Temperature:  93.7 (F)
           Absolute Humidity:  75. grains/lb
         Fuel Sulfur Content:  30. ppm

         Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
                 ATP Program:  No
            Reformulated Gas:  Yes

     Vehicle Type:   LDGV  LDGT12  LDGT34   LDGT   HDGV   LDDV   LDDT   HDDV     MC  All Veh
            GVWR:          <6000   >6000   (All)
                   ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
 VMT Distribution:  0.3163  0.3987  0.1568          0.0368  0.0002  0.0014  0.0858  0.0038  1.0000
Fuel Economy (mpg):   24.1    18.5    14.2    17.1     9.9    31.6    18.4     7.3    50.0    16.3
 --------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :   0.511   0.395   0.487   0.421   0.699   0.387   0.332   0.608    4.54   0.491
   Composite CO  :    5.03    4.65    5.22    4.81   11.02   2.071   0.761   2.674   25.25   4.996
   Composite NOX :   0.423   0.405   0.613   0.463   1.105   0.591   0.360   5.976    1.01   0.949
   Composite CO2 :   368.1   478.7   623.7   519.6   895.5   322.4   553.9  1401.7   177.4  559.89
 --------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS   URBAN   SCHOOL
                   ------  ------  ------
         VMT Mix:   0.0003  0.0009  0.0015
Fuel Economy (mpg):    6.4     4.3     6.2
---------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :   0.723   0.515   0.742
   Composite CO  :   17.83   4.187   2.481
   Composite NOX :   1.732   9.843   6.769
   Composite CO2 :  1375.1  2342.5  1646.7
---------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2011 20 mph - Summer
* File 1, Run 1, Scenario 5.
* # # # # # # # # # # # # # # # # # # # # # # # # #
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
       The user supplied arterial average speed of 20.0
       will be used for all hours of the day. 100% of VMT
       has been assigned to the arterial/collector roadway
       type for all hours of the day and all vehicle types.
 M 48 Warning:
        there are no sales for vehicle class HDGV8b

 LEV phase-in data read from file MA_LEV2.D
             Calendar Year:  2011
                  Month:  July
                Altitude:  Low
        Minimum Temperature:  70.4 (F)
        Maximum Temperature:  93.7 (F)
         Absolute Humidity:   75. grains/lb
        Fuel Sulfur Content:   30. ppm

        Exhaust I/M Program:  Yes
          Evap I/M Program:  Yes
             ATP Program:  No
          Reformulated Gas:  Yes

    Vehicle Type:     LDGV   LDGT12   LDGT34    LDGT    HDGV    LDDV    LDDT    HDDV      MC   All Veh
         GVWR:                <6000    >6000    (All)
                     ------   ------   ------   ------  ------  ------  ------  ------  ------  ------
  VMT Distribution:   0.3163   0.3987   0.1568           0.0368  0.0002  0.0014  0.0858  0.0038  1.0000
 Fuel Economy (mpg):    24.1     18.5     14.2     17.1     9.9    31.6    18.4     7.3    50.0    16.3
 ---------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
   Composite VOC :     0.448    0.342    0.422    0.365   0.562   0.337   0.286   0.499    4.09   0.424
   Composite CO  :     4.59     4.29     4.82     4.44    8.18    1.719   0.621   2.019   20.08   4.474
   Composite NOX :     0.376    0.369    0.561    0.423   1.156   0.530   0.322   5.359    1.06   0.861
   Composite CO2 :    368.1    478.7    623.7    519.6   895.5   322.4   553.9  1401.7   177.4  559.89
 ---------------------------------------------------------------------------------------------------------
      Veh. Type:   GasBUS   URBAN   SCHOOL
                   ------   ------  ------
        VMT Mix:   0.0003   0.0009  0.0015
 Fuel Economy (mpg):   6.4      4.3     6.2
---------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
   Composite VOC :   0.576    0.423   0.609
   Composite CO  :   13.24    3.162   1.874
   Composite NOX :   1.811    8.743   5.992
   Composite CO2 :  1375.1   2342.5  1646.7
---------------------------------------------------------------------------------------------------------

* ########################
* 2011 25 mph - Summer
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
* File 1, Run 1, Scenario 6.
* # # # # # # # # # # # # # # # # # # # # # # # # #

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 25.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
         there are no sales for vehicle class HDGV8b

 LEV phase-in data read from file MA_LEV2.D
              Calendar Year:  2011
                      Month:  July
                   Altitude:  Low
        Minimum Temperature:  70.4 (F)
        Maximum Temperature:  93.7 (F)
          Absolute Humidity:   75. grains/lb
        Fuel Sulfur Content:   30. ppm

          Exhaust I/M Program:  Yes
             Evap I/M Program:  Yes
                  ATP Program:  No
             Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
           GVWR:               <6000    >6000    (All)
                     ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3163   0.3987   0.1568             0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
 Fuel Economy (mpg):    24.1     18.5     14.2     17.1      9.9     31.6     18.4      7.3     50.0     16.3
 ----------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :    0.414    0.316    0.388    0.337    0.479    0.301    0.252    0.418     3.81    0.387
    Composite CO  :     4.40     4.14     4.66     4.29     6.42    1.491    0.530    1.596    16.91    4.214
    Composite NOX :    0.348    0.347    0.530    0.398    1.207    0.491    0.298    4.972     1.12    0.807
    Composite CO2 :    368.1    478.7    623.7    519.6    895.5    322.4    553.9   1401.7    177.4   559.89
 ----------------------------------------------------------------------------------------------------------------
         Veh. Type:   GasBUS    URBAN   SCHOOL
                      ------   ------   ------
          VMT Mix:    0.0003   0.0009   0.0015
 Fuel Economy (mpg):     6.4      4.3      6.2
----------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :    0.487    0.354    0.511
    Composite CO  :    10.39    2.499    1.481
    Composite NOX :    1.891    8.051    5.504
    Composite CO2 :   1375.1   2342.5   1646.7
----------------------------------------------------------------------------------------------------------------
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
* #########################
* 2011 30 mph - Summer
* File 1, Run 1, Scenario 7.
* #########################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 30.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
          there are no sales for vehicle class HDGV8b

 LEV phase-in data read from file MA_LEV2.D
               Calendar Year:  2011
                      Month:  July
                   Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
            Absolute Humidity:   75. grains/lb
          Fuel Sulfur Content:   30. ppm

          Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
                ATP Program:  No
           Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34    LDGT    HDGV    LDDV    LDDT    HDDV      MC   All Veh
          GVWR:               <6000    >6000    (All)
                     ------   ------   ------   ------   ------   ------   ------   ------   ------
 VMT Distribution:   0.3163   0.3987   0.1568            0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
 Fuel Economy (mpg):   24.1     18.5     14.2     17.1      9.9     31.6     18.4      7.3     50.0     16.3
 -------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
   Composite VOC :    0.392    0.300    0.368    0.319    0.423    0.274    0.227    0.358    3.60    0.362
   Composite CO  :     4.36     4.12     4.62     4.26     5.32    1.343    0.471    1.320   14.61    4.111
   Composite NOX :    0.328    0.332    0.509    0.382    1.258    0.471    0.286    4.769    1.17    0.776
   Composite CO2 :    368.1    478.7    623.7    519.6    895.5    322.4    553.9   1401.7   177.4   559.89
 -------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN   SCHOOL
                    ------   ------   ------
         VMT Mix:   0.0003   0.0009   0.0015
 Fuel Economy (mpg):   6.4      4.3      6.2
-------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
   Composite VOC :    0.427    0.304    0.438
   Composite CO  :     8.61    2.067    1.225
   Composite NOX :    1.971    7.689    5.248
   Composite CO2 :   1375.1   2342.5   1646.7
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2011 35 mph - Summer
* File 1, Run 1, Scenario 8.
* # # # # # # # # # # # # # # # # # # # # # # # # #

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
         The user supplied arterial average speed of 35.0
         will be used for all hours of the day. 100% of VMT
         has been assigned to the arterial/collector roadway
         type for all hours of the day and all vehicle types.
 M 48 Warning:
          there are no sales for vehicle class HDGV8b

 LEV phase-in data read from file MA_LEV2.D
               Calendar Year:  2011
                      Month:  July
                   Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
            Absolute Humidity:  75. grains/lb
          Fuel Sulfur Content:  30. ppm

          Exhaust I/M Program:  Yes
             Evap I/M Program:  Yes
                  ATP Program:  No
             Reformulated Gas:  Yes

     Vehicle Type:   LDGV   LDGT12   LDGT34    LDGT    HDGV    LDDV    LDDT    HDDV     MC   All Veh
           GVWR:             <6000    >6000    (All)
                    ------  ------  ------  ------  ------  ------  ------  ------  ------
 VMT Distribution:  0.3163  0.3987  0.1568          0.0368  0.0002  0.0014  0.0858  0.0038  1.0000
Fuel Economy (mpg):   24.1    18.5    14.2    17.1     9.9    31.6    18.4     7.3    50.0    16.3
 ------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
   Composite VOC :   0.376   0.288   0.353   0.307   0.385   0.254   0.208   0.314    3.44   0.344
   Composite CO  :    4.43    4.18    4.69    4.33    4.66   1.247   0.433   1.143   12.91   4.125
   Composite NOX :   0.316   0.325   0.499   0.374   1.308   0.467   0.283   4.728    1.22   0.767
   Composite CO2 :   368.1   478.7   623.7   519.6   895.5   322.4   553.9  1401.7   177.4  559.89
 ------------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS   URBAN   SCHOOL
                    ------  ------  ------
         VMT Mix:   0.0003  0.0009  0.0015
Fuel Economy (mpg):    6.4     4.3     6.2
------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
   Composite VOC :   0.386   0.266   0.384
   Composite CO  :    7.54   1.790   1.061
```

Table I-8 MOBILE6.2.03 Output Files for 2011

Composite NOX :	2.050	7.616	5.196
Composite CO2 :	1375.1	2342.5	1646.7

---

* #
* 2011 50 mph - Summer
* File 1, Run 1, Scenario 9.
* #

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
M583 Warning:
The user supplied arterial average speed of 50.0
will be used for all hours of the day. 100% of VMT
has been assigned to the arterial/collector roadway
type for all hours of the day and all vehicle types.
M 48 Warning:
there are no sales for vehicle class HDGV8b

LEV phase-in data read from file MA_LEV2.D
Calendar Year: 2011
Month: July
Altitude: Low
Minimum Temperature: 70.4 (F)
Maximum Temperature: 93.7 (F)
Absolute Humidity: 75. grains/lb
Fuel Sulfur Content: 30. ppm

Exhaust I/M Program: Yes
Evap I/M Program: Yes
ATP Program: No
Reformulated Gas: Yes

Vehicle Type:	LDGV	LDGT12	LDGT34	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
GVWR:		<6000	>6000	(All)						
	------	------	------	------	------	------	------	------	------	------
VMT Distribution:	0.3163	0.3987	0.1568		0.0368	0.0002	0.0014	0.0858	0.0038	1.0000
Fuel Economy (mpg):	24.1	18.5	14.2	17.1	9.9	31.6	18.4	7.3	50.0	16.3

Composite Emission Factors (g/mi):

Composite VOC :	0.350	0.274	0.333	0.291	0.322	0.221	0.177	0.241	3.24	0.318
Composite CO :	5.26	4.94	5.48	5.09	4.36	1.156	0.397	0.974	10.68	4.776
Composite NOX :	0.332	0.345	0.522	0.395	1.461	0.556	0.338	5.622	1.34	0.867
Composite CO2 :	368.1	478.7	623.7	519.6	895.5	322.4	553.9	1401.7	177.4	559.89

Veh. Type:	GasBUS	URBAN	SCHOOL
	------	------	------
VMT Mix:	0.0003	0.0009	0.0015
Fuel Economy (mpg):	6.4	4.3	6.2

Composite Emission Factors (g/mi):

Table I-8 MOBILE6.2.03 Output Files for 2011

```
     Composite VOC :    0.324    0.205    0.295
     Composite CO  :    7.05     1.525    0.904
     Composite NOX :    2.290    9.212    6.323
     Composite CO2 :  1375.1   2342.5   1646.7
-----------------------------------------------------------------------------------------------------------------
*****************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                   *
* Input file: MA11_ALL.INP (file 1, run 1). *
*****************************************************************************

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2011 Idle Scenario - Summer (multiply g/mi by 2.5 mph to get g/hr)
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                      Calendar Year:  2011
                             Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
            Diesel Fuel Sulfur Content:   15. ppm
                 Particle Size Cutoff: 10.00 Microns
                    Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34    LDGT    HDGV    LDDV    LDDT    HDDV     MC   All Veh
           GVWR:               <6000    >6000    (All)
                    ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
  VMT Distribution:   0.3163   0.3987   0.1568            0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
-----------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
             Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
            GASPM:   0.0039   0.0037   0.0037   0.0037   0.0258   ------   ------   ------   0.0205   0.0043
          ECARBON:   ------   ------   ------   ------   ------   0.0776   0.0139   0.0817   ------   0.0071
          OCARBON:   ------   ------   ------   ------   ------   0.0219   0.0200   0.0408   ------   0.0035
              SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0002   0.0003   0.0009   0.0002   0.0006
  Total Exhaust PM:   0.0044   0.0043   0.0043   0.0043   0.0271   0.0996   0.0342   0.1234   0.0207   0.0155
            Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
             Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0080   0.0080   0.0248   0.0040   0.0094
         Total PM:   0.0249   0.0249   0.0249   0.0249   0.0482   0.1202   0.0547   0.1608   0.0372   0.0375
              SO2:   0.0067   0.0087   0.0115   0.0095   0.0164   0.0030   0.0052   0.0131   0.0033   0.0091
              NH3:   0.1012   0.1016   0.1017   0.1016   0.0451   0.0068   0.0068   0.0270   0.0113   0.0925
-----------------------------------------------------------------------------------------------------------------
        Veh. Type:   GasBUS    URBAN   SCHOOL
                     ------   ------   ------
          VMT Mix:   0.0003   0.0009   0.0015
-----------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
             Lead:   0.0000   ------   ------
            GASPM:   0.0349   ------   ------
          ECARBON:   ------   0.1046   0.0623
          OCARBON:   ------   0.0822   0.0490
              SO4:   0.0013   0.0015   0.0011
  Total Exhaust PM:   0.0362   0.1882   0.1124
            Brake:   0.0125   0.0125   0.0125
             Tire:   0.0120   0.0120   0.0120
         Total PM:   0.0607   0.2128   0.1369
              SO2:   0.0253   0.0218   0.0153
              NH3:   0.0451   0.0270   0.0270
-----------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2011 5 mph - Summer
* File 1, Run 1, Scenario 2.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                      Calendar Year:  2011
                             Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
              Diesel Fuel Sulfur Content:   15. ppm
                 Particle Size Cutoff: 10.00 Microns
                   Reformulated Gas:  Yes

      Vehicle Type:    LDGV   LDGT12   LDGT34    LDGT    HDGV    LDDV    LDDT    HDDV     MC   All Veh
          GVWR:                <6000    >6000    (All)
                     ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
   VMT Distribution:   0.3163   0.3987   0.1568            0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
-----------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
         GASPM:   0.0039   0.0037   0.0037   0.0037   0.0258   ------   ------   ------   0.0205   0.0043
       ECARBON:   ------   ------   ------   ------   ------   0.0776   0.0139   0.0817   ------   0.0071
       OCARBON:   ------   ------   ------   ------   ------   0.0219   0.0200   0.0408   ------   0.0035
           SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0002   0.0003   0.0009   0.0002   0.0006
 Total Exhaust PM:   0.0044   0.0043   0.0043   0.0043   0.0271   0.0996   0.0342   0.1234   0.0207   0.0155
         Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
          Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0080   0.0080   0.0248   0.0040   0.0094
      Total PM:   0.0249   0.0249   0.0249   0.0249   0.0482   0.1202   0.0547   0.1608   0.0372   0.0375
           SO2:   0.0067   0.0087   0.0115   0.0095   0.0164   0.0030   0.0052   0.0131   0.0033   0.0091
           NH3:   0.1012   0.1016   0.1017   0.1016   0.0451   0.0068   0.0068   0.0270   0.0113   0.0925
-----------------------------------------------------------------------------------------------------------
       Veh. Type:    GasBUS    URBAN    SCHOOL
                     ------    ------   ------
         VMT Mix:   0.0003   0.0009   0.0015
-----------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
          Lead:   0.0000   ------   ------
         GASPM:   0.0349   ------   ------
       ECARBON:   ------   0.1046   0.0623
       OCARBON:   ------   0.0822   0.0490
           SO4:   0.0013   0.0015   0.0011
 Total Exhaust PM:   0.0362   0.1882   0.1124
         Brake:   0.0125   0.0125   0.0125
          Tire:   0.0120   0.0120   0.0120
      Total PM:   0.0607   0.2128   0.1369
           SO2:   0.0253   0.0218   0.0153
           NH3:   0.0451   0.0270   0.0270
-----------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2011 10 mph - Summer
* File 1, Run 1, Scenario 3.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                   Calendar Year:  2011
                          Month:  July
            Gasoline Fuel Sulfur Content:   30. ppm
              Diesel Fuel Sulfur Content:   15. ppm
                 Particle Size Cutoff: 10.00 Microns
                   Reformulated Gas:  Yes

      Vehicle Type:    LDGV   LDGT12   LDGT34    LDGT    HDGV    LDDV    LDDT    HDDV     MC   All Veh
          GVWR:                <6000    >6000    (All)
                     ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
   VMT Distribution:   0.3163   0.3987   0.1568            0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
-----------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
         GASPM:   0.0039   0.0037   0.0037   0.0037   0.0258   ------   ------   ------   0.0205   0.0043
       ECARBON:   ------   ------   ------   ------   ------   0.0776   0.0139   0.0817   ------   0.0071
       OCARBON:   ------   ------   ------   ------   ------   0.0219   0.0200   0.0408   ------   0.0035
           SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0002   0.0003   0.0009   0.0002   0.0006
 Total Exhaust PM:   0.0044   0.0043   0.0043   0.0043   0.0271   0.0996   0.0342   0.1234   0.0207   0.0155
         Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
          Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0080   0.0080   0.0248   0.0040   0.0094
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
        Total PM:   0.0249   0.0249   0.0249   0.0249   0.0482   0.1202   0.0547   0.1608   0.0372   0.0375
             SO2:   0.0067   0.0087   0.0115   0.0095   0.0164   0.0030   0.0052   0.0131   0.0033   0.0091
             NH3:   0.1012   0.1016   0.1017   0.1016   0.0451   0.0068   0.0068   0.0270   0.0113   0.0925
-------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS   URBAN   SCHOOL
                    ------   ------  ------
         VMT Mix:   0.0003   0.0009   0.0015
-------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
            Lead:   0.0000   ------   ------
           GASPM:   0.0349   ------   ------
         ECARBON:   ------   0.1046   0.0623
         OCARBON:   ------   0.0822   0.0490
             SO4:   0.0013   0.0015   0.0011
Total Exhaust PM:   0.0362   0.1882   0.1124
           Brake:   0.0125   0.0125   0.0125
            Tire:   0.0120   0.0120   0.0120
        Total PM:   0.0607   0.2128   0.1369
             SO2:   0.0253   0.0218   0.0153
             NH3:   0.0451   0.0270   0.0270
-------------------------------------------------------------------------------------------------------------

* #########################
* 2011 15 mph - Summer
* File 1, Run 1, Scenario 4.
* #########################

                      Calendar Year:  2011
                              Month:  July
      Gasoline Fuel Sulfur Content:   30. ppm
        Diesel Fuel Sulfur Content:   15. ppm
              Particle Size Cutoff: 10.00 Microns
                 Reformulated Gas:  Yes

    Vehicle Type:    LDGV   LDGT12   LDGT34    LDGT    HDGV    LDDV    LDDT    HDDV      MC   All Veh
            GVWR:            <6000    >6000   (All)
                    ------  ------   ------  ------  ------  ------  ------  ------  ------
VMT Distribution:   0.3163   0.3987   0.1568           0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
-------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
            Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
           GASPM:   0.0039   0.0037   0.0037   0.0037   0.0258   ------   ------   ------   0.0205   0.0043
         ECARBON:   ------   ------   ------   ------   ------   0.0776   0.0139   0.0817   ------   0.0071
         OCARBON:   ------   ------   ------   ------   ------   0.0219   0.0200   0.0408   ------   0.0035
             SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0002   0.0003   0.0009   0.0002   0.0006
Total Exhaust PM:   0.0044   0.0043   0.0043   0.0043   0.0271   0.0996   0.0342   0.1234   0.0207   0.0155
           Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
            Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0080   0.0080   0.0248   0.0040   0.0094
        Total PM:   0.0249   0.0249   0.0249   0.0249   0.0482   0.1202   0.0547   0.1608   0.0372   0.0375
             SO2:   0.0067   0.0087   0.0115   0.0095   0.0164   0.0030   0.0052   0.0131   0.0033   0.0091
             NH3:   0.1012   0.1016   0.1017   0.1016   0.0451   0.0068   0.0068   0.0270   0.0113   0.0925
-------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS   URBAN   SCHOOL
                    ------   ------  ------
         VMT Mix:   0.0003   0.0009   0.0015
-------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
            Lead:   0.0000   ------   ------
           GASPM:   0.0349   ------   ------
         ECARBON:   ------   0.1046   0.0623
         OCARBON:   ------   0.0822   0.0490
             SO4:   0.0013   0.0015   0.0011
Total Exhaust PM:   0.0362   0.1882   0.1124
           Brake:   0.0125   0.0125   0.0125
            Tire:   0.0120   0.0120   0.0120
        Total PM:   0.0607   0.2128   0.1369
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
            SO2:   0.0253   0.0218   0.0153
            NH3:   0.0451   0.0270   0.0270
-------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2011 20 mph - Summer
* File 1, Run 1, Scenario 5.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year:  2011
                           Month:  July
      Gasoline Fuel Sulfur Content:   30. ppm
        Diesel Fuel Sulfur Content:   15. ppm
            Particle Size Cutoff: 10.00 Microns
               Reformulated Gas:  Yes

    Vehicle Type:    LDGV   LDGT12   LDGT34    LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
         GVWR:               <6000    >6000   (All)
                   ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
 VMT Distribution:  0.3163   0.3987   0.1568             0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
-------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
         GASPM:   0.0039   0.0037   0.0037   0.0037   0.0258   ------   ------   ------   0.0205   0.0043
       ECARBON:   ------   ------   ------   ------   ------   0.0776   0.0139   0.0817   ------   0.0071
       OCARBON:   ------   ------   ------   ------   ------   0.0219   0.0200   0.0408   ------   0.0035
           SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0002   0.0003   0.0009   0.0002   0.0006
 Total Exhaust PM:   0.0044   0.0043   0.0043   0.0043   0.0271   0.0996   0.0342   0.1234   0.0207   0.0155
         Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
          Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0080   0.0080   0.0248   0.0040   0.0094
      Total PM:   0.0249   0.0249   0.0249   0.0249   0.0482   0.1202   0.0547   0.1608   0.0372   0.0375
           SO2:   0.0067   0.0088   0.0115   0.0095   0.0164   0.0030   0.0052   0.0131   0.0033   0.0091
           NH3:   0.1012   0.1016   0.1017   0.1016   0.0451   0.0068   0.0068   0.0270   0.0113   0.0925
-------------------------------------------------------------------------------
      Veh. Type:   GasBUS    URBAN   SCHOOL
                   ------   ------   ------
        VMT Mix:   0.0003   0.0009   0.0015
-------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   ------   ------
         GASPM:   0.0349   ------   ------
       ECARBON:   ------   0.1046   0.0623
       OCARBON:   ------   0.0822   0.0490
           SO4:   0.0013   0.0015   0.0011
 Total Exhaust PM:   0.0362   0.1882   0.1124
         Brake:   0.0125   0.0125   0.0125
          Tire:   0.0120   0.0120   0.0120
      Total PM:   0.0607   0.2128   0.1369
           SO2:   0.0253   0.0218   0.0153
           NH3:   0.0451   0.0270   0.0270
-------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2011 25 mph - Summer
* File 1, Run 1, Scenario 6.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year:  2011
                           Month:  July
      Gasoline Fuel Sulfur Content:   30. ppm
        Diesel Fuel Sulfur Content:   15. ppm
            Particle Size Cutoff: 10.00 Microns
               Reformulated Gas:  Yes

    Vehicle Type:    LDGV   LDGT12   LDGT34    LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
         GVWR:               <6000    >6000   (All)
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
                      ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
 VMT Distribution:   0.3163  0.3987  0.1568          0.0368  0.0002  0.0014  0.0858  0.0038  1.0000
--------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:  0.0000  0.0000  0.0000  0.0000  0.0000  ------  ------  ------  0.0000  0.0000
         GASPM:  0.0039  0.0038  0.0038  0.0038  0.0257  ------  ------  ------  0.0205  0.0044
       ECARBON:  ------  ------  ------  ------  ------  0.0776  0.0139  0.0817  ------  0.0071
       OCARBON:  ------  ------  ------  ------  ------  0.0219  0.0200  0.0408  ------  0.0035
           SO4:  0.0004  0.0005  0.0005  0.0005  0.0015  0.0002  0.0003  0.0009  0.0001  0.0006
 Total Exhaust PM:  0.0043  0.0043  0.0043  0.0043  0.0272  0.0996  0.0342  0.1234  0.0206  0.0155
         Brake:  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125
          Tire:  0.0080  0.0080  0.0080  0.0080  0.0085  0.0080  0.0080  0.0248  0.0040  0.0094
      Total PM:  0.0249  0.0249  0.0249  0.0249  0.0483  0.1202  0.0547  0.1608  0.0372  0.0375
           SO2:  0.0067  0.0088  0.0115  0.0095  0.0163  0.0030  0.0052  0.0131  0.0033  0.0092
           NH3:  0.1012  0.1016  0.1017  0.1016  0.0451  0.0068  0.0068  0.0270  0.0113  0.0925
--------------------------------------------------------------------------------------------------------
      Veh. Type:  GasBUS  URBAN  SCHOOL
                  ------  ------  ------
        VMT Mix:  0.0003  0.0009  0.0015
--------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:  0.0000  ------  ------
         GASPM:  0.0347  ------  ------
       ECARBON:  ------  0.1046  0.0623
       OCARBON:  ------  0.0822  0.0490
           SO4:  0.0015  0.0015  0.0011
 Total Exhaust PM:  0.0363  0.1882  0.1124
         Brake:  0.0125  0.0125  0.0125
          Tire:  0.0120  0.0120  0.0120
      Total PM:  0.0608  0.2128  0.1369
           SO2:  0.0253  0.0218  0.0153
           NH3:  0.0451  0.0270  0.0270
--------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2011 30 mph - Summer
* File 1, Run 1, Scenario 7.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year:  2011
                           Month:  July
        Gasoline Fuel Sulfur Content:   30. ppm
          Diesel Fuel Sulfur Content:   15. ppm
              Particle Size Cutoff: 10.00 Microns
                 Reformulated Gas:  Yes

    Vehicle Type:    LDGV   LDGT12  LDGT34    LDGT    HDGV    LDDV    LDDT    HDDV      MC  All Veh
          GVWR:              <6000   >6000    (All)
                  ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
 VMT Distribution:   0.3163  0.3987  0.1568          0.0368  0.0002  0.0014  0.0858  0.0038  1.0000
--------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:  0.0000  0.0000  0.0000  0.0000  0.0000  ------  ------  ------  0.0000  0.0000
         GASPM:  0.0040  0.0038  0.0038  0.0038  0.0255  ------  ------  ------  0.0205  0.0044
       ECARBON:  ------  ------  ------  ------  ------  0.0776  0.0139  0.0817  ------  0.0071
       OCARBON:  ------  ------  ------  ------  ------  0.0219  0.0200  0.0408  ------  0.0035
           SO4:  0.0003  0.0005  0.0005  0.0005  0.0017  0.0002  0.0003  0.0009  0.0001  0.0005
 Total Exhaust PM:  0.0043  0.0043  0.0043  0.0043  0.0273  0.0996  0.0342  0.1234  0.0206  0.0155
         Brake:  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125
          Tire:  0.0080  0.0080  0.0080  0.0080  0.0085  0.0080  0.0080  0.0248  0.0040  0.0094
      Total PM:  0.0248  0.0249  0.0249  0.0249  0.0483  0.1202  0.0547  0.1608  0.0371  0.0375
           SO2:  0.0067  0.0088  0.0115  0.0096  0.0162  0.0030  0.0052  0.0131  0.0033  0.0092
           NH3:  0.1012  0.1016  0.1017  0.1016  0.0451  0.0068  0.0068  0.0270  0.0113  0.0925
--------------------------------------------------------------------------------------------------------
      Veh. Type:  GasBUS  URBAN  SCHOOL
                  ------  ------  ------
```

Table I-8 MOBILE6.2.03 Output Files for 2011

VMT Mix:	0.0003	0.0009	0.0015

Composite Emission Factors (g/mi):

Lead:	0.0000	------	------
GASPM:	0.0346	------	------
ECARBON:	------	0.1046	0.0623
OCARBON:	------	0.0822	0.0490
SO4:	0.0017	0.0015	0.0011
Total Exhaust PM:	0.0364	0.1882	0.1124
Brake:	0.0125	0.0125	0.0125
Tire:	0.0120	0.0120	0.0120
Total PM:	0.0609	0.2128	0.1369
SO2:	0.0252	0.0218	0.0153
NH3:	0.0451	0.0270	0.0270

---

* #
* 2011 35 mph - Summer
* File 1, Run 1, Scenario 8.
* #

Calendar Year: 2011
Month: July
Gasoline Fuel Sulfur Content: 30. ppm
Diesel Fuel Sulfur Content: 15. ppm
Particle Size Cutoff: 10.00 Microns
Reformulated Gas: Yes

Vehicle Type:	LDGV	LDGT12	LDGT34	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
GVWR:		<6000	>6000	(All)						
	------	------	------	------	------	------	------	------	------	------
VMT Distribution:	0.3163	0.3987	0.1568		0.0368	0.0002	0.0014	0.0858	0.0038	1.0000

Composite Emission Factors (g/mi):

	LDGV	LDGT12	LDGT34	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Lead:	0.0000	0.0000	0.0000	0.0000	0.0000	------	------	------	0.0000	0.0000
GASPM:	0.0040	0.0039	0.0039	0.0039	0.0254	------	------	------	0.0205	0.0044
ECARBON:	------	------	------	------	------	0.0776	0.0139	0.0817	------	0.0071
OCARBON:	------	------	------	------	------	0.0219	0.0200	0.0408	------	0.0035
SO4:	0.0002	0.0004	0.0004	0.0004	0.0019	0.0002	0.0003	0.0009	0.0001	0.0005
Total Exhaust PM:	0.0043	0.0043	0.0043	0.0043	0.0273	0.0996	0.0342	0.1234	0.0206	0.0155
Brake:	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
Tire:	0.0080	0.0080	0.0080	0.0080	0.0085	0.0080	0.0080	0.0248	0.0040	0.0094
Total PM:	0.0248	0.0249	0.0248	0.0249	0.0484	0.1202	0.0547	0.1608	0.0371	0.0375
SO2:	0.0067	0.0088	0.0115	0.0096	0.0162	0.0030	0.0052	0.0131	0.0033	0.0092
NH3:	0.1012	0.1016	0.1017	0.1016	0.0451	0.0068	0.0068	0.0270	0.0113	0.0925

Veh. Type:	GasBUS	URBAN	SCHOOL
	------	------	------
VMT Mix:	0.0003	0.0009	0.0015

Composite Emission Factors (g/mi):

Lead:	0.0000	------	------
GASPM:	0.0345	------	------
ECARBON:	------	0.1046	0.0623
OCARBON:	------	0.0822	0.0490
SO4:	0.0019	0.0015	0.0011
Total Exhaust PM:	0.0364	0.1882	0.1124
Brake:	0.0125	0.0125	0.0125
Tire:	0.0120	0.0120	0.0120
Total PM:	0.0610	0.2128	0.1369
SO2:	0.0251	0.0218	0.0153
NH3:	0.0451	0.0270	0.0270

---

* #
* 2011 50 mph - Summer

Table I-8 MOBILE6.2.03 Output Files for 2011

* File 1, Run 1, Scenario 9.
* #

Calendar Year: 2011
Month: July
Gasoline Fuel Sulfur Content: 30. ppm
Diesel Fuel Sulfur Content: 15. ppm
Particle Size Cutoff: 10.00 Microns
Reformulated Gas: Yes

Vehicle Type:	LDGV	LDGT12	LDGT34	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
GVWR:		<6000	>6000	(All)						
VMT Distribution:	0.3163	0.3987	0.1568		0.0368	0.0002	0.0014	0.0858	0.0038	1.0000
Composite Emission Factors (g/mi):										
Lead:	0.0000	0.0000	0.0000	0.0000	0.0000	------	------	------	0.0000	0.0000
GASPM:	0.0040	0.0039	0.0039	0.0039	0.0254	------	------	------	0.0205	0.0044
ECARBON:	------	------	------	------	------	0.0776	0.0139	0.0817	------	0.0071
OCARBON:	------	------	------	------	------	0.0219	0.0200	0.0408	------	0.0035
SO4:	0.0002	0.0004	0.0004	0.0004	0.0019	0.0002	0.0003	0.0009	0.0001	0.0005
Total Exhaust PM:	0.0043	0.0043	0.0043	0.0043	0.0273	0.0996	0.0342	0.1234	0.0206	0.0155
Brake:	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
Tire:	0.0080	0.0080	0.0080	0.0080	0.0085	0.0080	0.0080	0.0248	0.0040	0.0094
Total PM:	0.0248	0.0249	0.0248	0.0249	0.0484	0.1202	0.0547	0.1608	0.0371	0.0375
SO2:	0.0067	0.0088	0.0115	0.0096	0.0162	0.0030	0.0052	0.0131	0.0033	0.0092
NH3:	0.1012	0.1016	0.1017	0.1016	0.0451	0.0068	0.0068	0.0270	0.0113	0.0925

Veh. Type:	GasBUS	URBAN	SCHOOL
VMT Mix:	0.0003	0.0009	0.0015
Composite Emission Factors (g/mi):			
Lead:	0.0000	------	------
GASPM:	0.0345	------	------
ECARBON:	------	0.1046	0.0623
OCARBON:	------	0.0822	0.0490
SO4:	0.0019	0.0015	0.0011
Total Exhaust PM:	0.0364	0.1882	0.1124
Brake:	0.0125	0.0125	0.0125
Tire:	0.0120	0.0120	0.0120
Total PM:	0.0610	0.2128	0.1369
SO2:	0.0251	0.0218	0.0153
NH3:	0.0451	0.0270	0.0270

Source: KBE and Massport.

Table I-9 MOBILE6.2.03 Input File for 2030

```
* Calendar Year 2030 Generic MOBILE6 input file for Mesoscale Build/No-Build Analyses
* Filename MA30_ALL.INP created by Craig Woleader, MADEP 617-348-4046, craig.woleader@state.ma.us and Marc Bennett, MADEP 617-292-5597,
marc.bennett@state.ma.us
* revised 12/2/05 to include actual diesel rebuild effects
* revised 12/17/08 to include new IM program  for 2030
* revised 11/1/09 to update diesel fractions
* revised 8/28/12 by Wayne Arner, KBE, for specific speeds
*
***************    Header Section    ***************
MOBILE6 INPUT FILE
*
PARTICULATES      :
POLLUTANTS        : HC CO NOX CO2
DATABASE OUTPUT   :
WITH FIELDNAMES   :
AGGREGATED OUTPUT :
EMISSIONS TABLE   : MA30_MES.tb1 REPLACE
REPORT FILE       : MA30_MES.txt REPLACE
*
RUN DATA
***************    Run Section #1    ***************
> *** Summer 2030 ***

* Pollutant output format
EXPRESS HC AS VOC  :
EXPAND BUS EFS     :

* Mass. specific user inputs -- require external data file
REG DIST          : 2005_REG.D
I/M DESC FILE     : 09NEWIM.D

* Set Diesel Rebuild effects to 10% as per EPA
REBUILD EFFECTS   : 0.10

STAGE II REFUELING :
91 3 84. 84.

* Inputs for LEV II
94+ LDG IMP       : MA_LEV2.D
T2 EXH PHASE-IN   : LEV2EXH.D
T2 EVAP PHASE-IN  : LEV2EVAP.D
T2 CERT           : LEV2CERT.D

* Meteorological inputs
MIN/MAX TEMP      : 70.4 93.7

* Fuel inputs
FUEL RVP          : 6.8
FUEL PROGRAM      : 2 N

DIESEL FRACTIONS  :
0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000
0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000
0.000  0.000  0.000  0.000  0.000
0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001
0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001
0.001  0.001  0.001  0.001  0.001
0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001
0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001
0.001  0.001  0.001  0.001  0.001
0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005
0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005
0.005  0.005  0.005  0.005  0.005
0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005
0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005
0.005  0.005  0.005  0.005  0.005
```

Table I-9 MOBILE6.2.03 Input File for 2030

0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176
0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176
0.176	0.176	0.176	0.176	0.176					
0.385	0.385	0.385	0.385	0.385	0.385	0.385	0.385	0.385	0.385
0.385	0.385	0.385	0.385	0.385	0.385	0.385	0.385	0.385	0.385
0.385	0.385	0.385	0.385	0.385					
0.674	0.674	0.674	0.674	0.674	0.674	0.674	0.674	0.674	0.674
0.674	0.674	0.674	0.674	0.674	0.674	0.674	0.674	0.674	0.674
0.674	0.674	0.674	0.674	0.674					
0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830
0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830
0.830	0.830	0.830	0.830	0.830					
0.884	0.884	0.884	0.884	0.884	0.884	0.884	0.884	0.884	0.884
0.884	0.884	0.884	0.884	0.884	0.884	0.884	0.884	0.884	0.884
0.884	0.884	0.884	0.884	0.884					
0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977
0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977
0.977	0.977	0.977	0.977	0.977					
0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972
0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972	0.972
0.972	0.972	0.972	0.972	0.972					
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1.000	1.000	1.000	1.000	1.000					
0.786	0.786	0.786	0.786	0.786	0.786	0.786	0.786	0.786	0.786
0.786	0.786	0.786	0.786	0.786	0.786	0.786	0.786	0.786	0.786
0.786	0.786	0.786	0.786	0.786					

*************** Scenario Section ***************

SCENARIO RECORD : 2030 Idle Scenario - Summer (multiply g/mi by 2.5 mph to get g/hr)
CALENDAR YEAR : 2030
EVALUATION MONTH : 7
PARTICULATE EF : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE : 10
DIESEL SULFUR : 15
AVERAGE SPEED : 2.5 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD : 2030 5 mph - Summer
CALENDAR YEAR : 2030
EVALUATION MONTH : 7
PARTICULATE EF : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE : 10
DIESEL SULFUR : 15
AVERAGE SPEED : 5 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD : 2030 10 mph - Summer
CALENDAR YEAR : 2030
EVALUATION MONTH : 7
PARTICULATE EF : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE : 10
DIESEL SULFUR : 15
AVERAGE SPEED : 10 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD : 2030 15 mph - Summer
CALENDAR YEAR : 2030
EVALUATION MONTH : 7
PARTICULATE EF : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV PMDDR2.CSV
PARTICLE SIZE : 10
DIESEL SULFUR : 15
AVERAGE SPEED : 15 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD : 2030 20 mph - Summer
CALENDAR YEAR : 2030
EVALUATION MONTH : 7

Table I-9 MOBILE6.2.03 Input File for 2030

```
PARTICULATE EF     : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE      : 10
DIESEL SULFUR      : 15
AVERAGE SPEED      : 20 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD    : 2030 25 mph - Summer
CALENDAR YEAR      : 2030
EVALUATION MONTH   : 7
PARTICULATE EF     : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE      : 10
DIESEL SULFUR      : 15
AVERAGE SPEED      : 25 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD    : 2030 30 mph - Summer
CALENDAR YEAR      : 2030
EVALUATION MONTH   : 7
PARTICULATE EF     : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE      : 10
DIESEL SULFUR      : 15
AVERAGE SPEED      : 30 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD    : 2030 35 mph - Summer
CALENDAR YEAR      : 2030
EVALUATION MONTH   : 7
PARTICULATE EF     : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE      : 10
DIESEL SULFUR      : 15
AVERAGE SPEED      : 35 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD    : 2030 50 mph - Summer
CALENDAR YEAR      : 2030
EVALUATION MONTH   : 7
PARTICULATE EF     : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE      : 10
DIESEL SULFUR      : 15
AVERAGE SPEED      : 50 Arterial 0.0 100.0 0.0 0.0

***************   End of This Run   ***************
END OF RUN
```

Source: KBE and Massport.

Table I-10 MOBILE6.2.03 Output Files for 2030

```
****************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                    *
* Input file: MA30_ALL.INP (file 1, run 1). *
****************************************************************************
* *** Summer 2030 ***

* Reading Registration Distributions from the following external
* data file: 2005_REG.D
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
         0.998    MYR sum not = 1. (will normalize)
 M 49 Warning:
         0.998    MYR sum not = 1. (will normalize)
 M 49 Warning:
         0.998    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
         0.999    MYR sum not = 1. (will normalize)
 M 49 Warning:
         0.998    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
         0.999    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)

* Reading I/M program description records from the following external
* data file: 09NEWIM.D
* 15 Year Exemption Age
* New Annual OBD Exhaust I/M program for Light Duty MY 1996 through 2007 vehicles <=8,500 lb GVWR
* New Annual OBD Exhaust I/M program for Light Duty and Medium duty MY 2008 and later <=14,000 lb GVWR
* New Annual OBD Evap I/M program for Light Duty MY 1996 through 2007 vehicles <=8,500 lb GVWR
* New Annual OBD Evap I/M program for for Light Duty and Medium duty MY 2008 and later <=14,000 lb GVWR
 M601 Comment:
         User has enabled STAGE II REFUELING.


* Reading 94+ LEV IMPLEMENTATION SCHEDULE from the following external
* data file: MA_LEV2.D

 Reading User Supplied Tier2 Exhaust bin phase-in fractions

   Data read from file: LEV2EXH.D


 Reading User Supplied Tier2 EVAP phase-in fractions

   Data read from file: LEV2EVAP.D


 Reading User Supplied Tier2 50K certification standards

   Data read from file: LEV2CERT.D

 M616 Comment:
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
        User has supplied post-1999 sulfur levels.
  M614 Comment:
        User supplied diesel sale fractions.

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2030 Idle Scenario - Summer (multiply g/mi by 2.5 mph to get g/hr)
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # #

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M583 Warning:
       The user supplied arterial average speed of  2.5
       will be used for all hours of the day. 100% of VMT
       has been assigned to the arterial/collector roadway
       type for all hours of the day and all vehicle types.
*** I/M credits for Tech1&2 vehicles were read from the following external
   data file: TECH12.D
  M 48 Warning:
        there are no sales for vehicle class HDGV8b
  M 48 Warning:
        there are no sales for vehicle class LDDV
 HDDV DEFEAT DEVICE EFFECTS ARE PRESENT. THE REBUILD FRACTION IS 0.10.

* Reading Ammonia (NH3) Basic Emission Rates
* from the external data file PMNH3BER.D

* Reading Ammonia (NH3) Sulfur Deterioration Rates
* from the external data file PMNH3SDR.D

 LEV phase-in data read from file MA_LEV2.D
              Calendar Year:  2030
                      Month:  July
                   Altitude:  Low
        Minimum Temperature:  70.4 (F)
        Maximum Temperature:  93.7 (F)
          Absolute Humidity:   75. grains/lb
        Fuel Sulfur Content:   30. ppm

        Exhaust I/M Program:  Yes
           Evap I/M Program:  Yes
                ATP Program:  No
          Reformulated Gas:  Yes

     Vehicle Type:   LDGV   LDGT12  LDGT34   LDGT    HDGV    LDDV    LDDT    HDDV     MC   All Veh
          GVWR:              <6000   >6000   (All)
                    ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
  VMT Distribution:  0.2607  0.4379  0.1723           0.0375  0.0000  0.0015  0.0864  0.0036  1.0000
 Fuel Economy (mpg):   24.1    18.5    14.2    17.0     9.9     0.0    18.4     7.3    50.0    16.0
 ---------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
   Composite VOC :    1.567    1.352    1.389    1.363    1.581   0.000    0.159    0.732    11.46    1.405
   Composite CO  :   10.06     9.23     9.54     9.32    25.09   0.000    0.997    1.040   120.29    9.777
   Composite NOX :    0.292    0.254    0.332    0.276    0.122   0.000    0.066    0.898     1.12    0.331
   Composite CO2 :   368.0    479.4    624.6    520.4    894.5     0.0    552.2   1398.5    177.4   569.40
 -------------------------------------------------------------------------------------------------------
       Veh. Type:    GasBUS    URBAN    SCHOOL
                     ------    ------   ------
         VMT Mix:    0.0004    0.0009   0.0014
 Fuel Economy (mpg):    6.4       4.4      6.2
 -------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
   Composite VOC :    1.830    0.733    0.878
   Composite CO  :   51.03     1.650    0.975
   Composite NOX :    0.206    1.571    0.942
   Composite CO2 :  1375.0   2334.1   1646.7
 -------------------------------------------------------------------------------------------------------

* #########################
* 2030 5 mph - Summer
* File 1, Run 1, Scenario 2.
* #########################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of  5.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
          there are no sales for vehicle class HDGV8b
 M 48 Warning:
          there are no sales for vehicle class LDDV

 LEV phase-in data read from file MA_LEV2.D
              Calendar Year:  2030
                     Month:  July
                  Altitude:  Low
        Minimum Temperature:  70.4 (F)
        Maximum Temperature:  93.7 (F)
          Absolute Humidity:  75. grains/lb
        Fuel Sulfur Content:  30. ppm

          Exhaust I/M Program:  Yes
             Evap I/M Program:  Yes
                 ATP Program:  No
            Reformulated Gas:  Yes

     Vehicle Type:    LDGV   LDGT12   LDGT34    LDGT    HDGV    LDDV    LDDT    HDDV      MC   All Veh
             GVWR:            <6000    >6000    (All)
                     ------   ------   ------   ------  ------  ------  ------  ------  ------  ------
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
  VMT Distribution:   0.2607   0.4379   0.1723            0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
 Fuel Economy (mpg):     24.1     18.5     14.2     17.0      9.9      0.0     18.4      7.3     50.0     16.0
 --------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
   Composite VOC :    0.553    0.527    0.572    0.540    0.699    0.000    0.142    0.644     7.73    0.584
   Composite CO  :     6.03     5.93     6.13     5.99    20.05    0.000    0.829    0.849    71.17    6.310
   Composite NOX :    0.241    0.221    0.287    0.239    0.125    0.000    0.059    0.807     1.05    0.287
   Composite CO2 :    368.0    479.4    624.6    520.4    894.5      0.0    552.2   1398.5    177.4   569.40
 --------------------------------------------------------------------------------------------------------
        Veh. Type:   GasBUS    URBAN   SCHOOL
                     ------   ------   ------
          VMT Mix:   0.0004   0.0009   0.0014
 Fuel Economy (mpg):    6.4      4.4      6.2
 --------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
   Composite VOC :    0.906    0.644    0.772
   Composite CO  :    40.77    1.347    0.796
   Composite NOX :    0.211    1.412    0.847
   Composite CO2 :   1375.0   2334.1   1646.7
 --------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2030 10 mph - Summer
* File 1, Run 1, Scenario 3.
* # # # # # # # # # # # # # # # # # # # # # # # # #

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M583 Warning:
        The user supplied arterial average speed of 10.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
  M 48 Warning:
         there are no sales for vehicle class HDGV8b
  M 48 Warning:
         there are no sales for vehicle class LDDV

 LEV phase-in data read from file MA_LEV2.D
              Calendar Year:  2030
                      Month:  July
                   Altitude:  Low
        Minimum Temperature:  70.4 (F)
        Maximum Temperature:  93.7 (F)
          Absolute Humidity:  75. grains/lb
         Fuel Sulfur Content:  30. ppm

         Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
                 ATP Program:  No
           Reformulated Gas:  Yes
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
      Vehicle Type:     LDGV   LDGT12  LDGT34    LDGT    HDGV    LDDV    LDDT    HDDV     MC  All Veh
          GVWR:                 <6000   >6000    (All)
                      ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
   VMT Distribution:  0.2607  0.4379  0.1723          0.0375  0.0000  0.0015  0.0864  0.0036  1.0000
 Fuel Economy (mpg):    24.1    18.5    14.2    17.0     9.9     0.0    18.4     7.3    50.0    16.0
 ---------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :    0.299   0.300   0.335   0.310   0.411   0.000   0.114   0.505    4.91   0.344
    Composite CO  :     4.15    4.32    4.46    4.36   13.34   0.000   0.598   0.585   36.49   4.429
    Composite NOX :    0.180   0.176   0.228   0.191   0.131   0.000   0.049   0.669    1.00   0.230
    Composite CO2 :    368.0   479.4   624.6   520.4   894.5     0.0   552.2  1398.5   177.4  569.40
 ---------------------------------------------------------------------------------------------------
        Veh. Type:   GasBUS   URBAN  SCHOOL
                     ------  ------  ------
          VMT Mix:   0.0004  0.0009  0.0014
 Fuel Economy (mpg):    6.4     4.4     6.2
----------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :   0.580   0.505   0.606
    Composite CO  :   27.13   0.929   0.549
    Composite NOX :   0.222   1.171   0.703
    Composite CO2 :  1375.0  2334.1  1646.7
----------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2030 15 mph - Summer
* File 1, Run 1, Scenario 4.
* # # # # # # # # # # # # # # # # # # # # # # # # #

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
          The user supplied arterial average speed of 15.0
          will be used for all hours of the day. 100% of VMT
          has been assigned to the arterial/collector roadway
          type for all hours of the day and all vehicle types.
 M 48 Warning:
           there are no sales for vehicle class HDGV8b
 M 48 Warning:
           there are no sales for vehicle class LDDV

 LEV phase-in data read from file MA_LEV2.D
              Calendar Year:  2030
                     Month:  July
                  Altitude:  Low
         Minimum Temperature:  70.4 (F)
         Maximum Temperature:  93.7 (F)
           Absolute Humidity:   75. grains/lb
         Fuel Sulfur Content:   30. ppm
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
          Exhaust I/M Program:  Yes
             Evap I/M Program:  Yes
                  ATP Program:  No
             Reformulated Gas:  Yes

      Vehicle Type:    LDGV  LDGT12  LDGT34    LDGT    HDGV    LDDV    LDDT    HDDV      MC  All Veh
              GVWR:           <6000   >6000   (All)
                     ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
  VMT Distribution:  0.2607  0.4379  0.1723          0.0375  0.0000  0.0015  0.0864  0.0036  1.0000
Fuel Economy (mpg):    24.1    18.5    14.2    17.0     9.9     0.0    18.4     7.3    50.0    16.0
 ------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :    0.238   0.238   0.267   0.246   0.309   0.000   0.095   0.406    3.94   0.273
   Composite CO  :     3.59    3.77    3.90    3.81    9.37   0.000   0.455   0.422   25.25   3.739
   Composite NOX :    0.145   0.148   0.191   0.160   0.138   0.000   0.043   0.576    1.01   0.194
   Composite CO2 :    368.0   479.4   624.6   520.4   894.5     0.0   552.2  1398.5   177.4  569.40
 ------------------------------------------------------------------------------------------------
         Veh. Type:  GasBUS   URBAN  SCHOOL
                     ------  ------  ------
           VMT Mix:  0.0004  0.0009  0.0014
Fuel Economy (mpg):     6.4     4.4     6.2
------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :    0.458   0.406   0.486
   Composite CO  :    19.07   0.670   0.396
   Composite NOX :    0.233   1.007   0.604
   Composite CO2 :   1375.0  2334.1  1646.7
------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2030 20 mph - Summer
* File 1, Run 1, Scenario 5.
* # # # # # # # # # # # # # # # # # # # # # # # # #

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
         The user supplied arterial average speed of 20.0
         will be used for all hours of the day. 100% of VMT
         has been assigned to the arterial/collector roadway
         type for all hours of the day and all vehicle types.
 M 48 Warning:
           there are no sales for vehicle class HDGV8b
 M 48 Warning:
           there are no sales for vehicle class LDDV

 LEV phase-in data read from file MA_LEV2.D
               Calendar Year:  2030
                       Month:  July
                    Altitude:  Low
         Minimum Temperature:  70.4 (F)
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
          Maximum Temperature:  93.7 (F)
           Absolute Humidity:   75. grains/lb
          Fuel Sulfur Content:   30. ppm

          Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
               ATP Program:  No
            Reformulated Gas:  Yes

      Vehicle Type:     LDGV    LDGT12   LDGT34     LDGT      HDGV      LDDV      LDDT      HDDV       MC   All Veh
           GVWR:                 <6000     >6000     (All)
                    ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607    0.4379    0.1723              0.0375    0.0000    0.0015    0.0864    0.0036    1.0000
 Fuel Economy (mpg):      24.1      18.5      14.2      17.0       9.9       0.0      18.4       7.3      50.0      16.0
 ------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     0.203     0.200     0.226     0.208     0.246    0.000     0.080     0.333      3.50     0.230
    Composite CO  :     3.24      3.44      3.56      3.47      6.96     0.000     0.364     0.319    20.08     3.325
    Composite NOX :     0.127     0.134     0.173     0.145     0.144    0.000     0.038     0.513      1.06     0.175
    Composite CO2 :    368.0     479.4     624.6     520.4     894.5      0.0     552.2    1398.5     177.4    569.40
 ------------------------------------------------------------------------------------------------------------------
        Veh. Type:    GasBUS     URBAN    SCHOOL
                    ------   ------   ------
         VMT Mix:    0.0004    0.0009    0.0014
 Fuel Economy (mpg):       6.4       4.4       6.2
------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     0.382     0.333     0.399
    Composite CO  :    14.16      0.506     0.299
    Composite NOX :     0.244     0.897     0.538
    Composite CO2 :  1375.0    2334.1    1646.7
------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2030 25 mph - Summer
* File 1, Run 1, Scenario 6.
* # # # # # # # # # # # # # # # # # # # # # # # # #

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
         The user supplied arterial average speed of 25.0
         will be used for all hours of the day. 100% of VMT
         has been assigned to the arterial/collector roadway
         type for all hours of the day and all vehicle types.
 M 48 Warning:
          there are no sales for vehicle class HDGV8b
 M 48 Warning:
          there are no sales for vehicle class LDDV

 LEV phase-in data read from file MA_LEV2.D
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
                Calendar Year:  2030
                        Month:  July
                     Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
            Absolute Humidity:  75. grains/lb
          Fuel Sulfur Content:  30. ppm

           Exhaust I/M Program:  Yes
              Evap I/M Program:  Yes
                   ATP Program:  No
             Reformulated Gas:  Yes

      Vehicle Type:     LDGV    LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
           GVWR:               <6000    >6000     (All)
                        ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607   0.4379   0.1723             0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
Fuel Economy (mpg):     24.1     18.5     14.2     17.0      9.9      0.0     18.4      7.3     50.0     16.0
 ------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
    Composite VOC :    0.184    0.183    0.207    0.190    0.210    0.000    0.070    0.279     3.22    0.208
    Composite CO  :     3.08     3.28     3.40     3.31     5.46    0.000    0.306    0.252    16.91    3.114
    Composite NOX :    0.116    0.125    0.161    0.135    0.150    0.000    0.035    0.473     1.12    0.163
    Composite CO2 :    368.0    479.4    624.6    520.4    894.5      0.0    552.2   1398.5    177.4   569.40
 ------------------------------------------------------------------------------------------------------------
        Veh. Type:   GasBUS    URBAN   SCHOOL
                     ------   ------   ------
          VMT Mix:   0.0004   0.0009   0.0014
Fuel Economy (mpg):     6.4      4.4      6.2
-------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
    Composite VOC :   0.337    0.279    0.334
    Composite CO  :   11.11    0.400    0.236
    Composite NOX :   0.254    0.828    0.497
    Composite CO2 :  1375.0   2334.1   1646.7
-------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2030 30 mph - Summer
* File 1, Run 1, Scenario 7.
* # # # # # # # # # # # # # # # # # # # # # # # # #

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M583 Warning:
           The user supplied arterial average speed of 30.0
           will be used for all hours of the day. 100% of VMT
           has been assigned to the arterial/collector roadway
           type for all hours of the day and all vehicle types.
  M 48 Warning:
            there are no sales for vehicle class HDGV8b
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
 M 48 Warning:
          there are no sales for vehicle class LDDV

 LEV phase-in data read from file MA_LEV2.D
               Calendar Year:  2030
                      Month:  July
                   Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
            Absolute Humidity:   75. grains/lb
          Fuel Sulfur Content:   30. ppm

          Exhaust I/M Program:  Yes
             Evap I/M Program:  Yes
                 ATP Program:  No
             Reformulated Gas:  Yes

     Vehicle Type:      LDGV    LDGT12   LDGT34     LDGT      HDGV     LDDV      LDDT     HDDV        MC   All Veh
          GVWR:                 <6000    >6000      (All)
                       ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607   0.4379   0.1723             0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
 Fuel Economy (mpg):    24.1     18.5     14.2     17.0      9.9      0.0     18.4      7.3     50.0     16.0
 ----------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :    0.172    0.172    0.194    0.178    0.185    0.000    0.062    0.239     3.02    0.192
    Composite CO  :     3.03     3.23     3.35     3.27     4.53    0.000    0.267    0.209    14.61    3.026
    Composite NOX :    0.108    0.119    0.154    0.129    0.157    0.000    0.034    0.452     1.17    0.156
    Composite CO2 :    368.0    479.4    624.6    520.4    894.5      0.0    552.2   1398.5    177.4   569.40
 ----------------------------------------------------------------------------------------------------------------
         Veh. Type:   GasBUS    URBAN   SCHOOL
                       ------   ------   ------
          VMT Mix:    0.0004   0.0009   0.0014
 Fuel Economy (mpg):     6.4      4.4      6.2
-----------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :    0.306    0.239    0.287
    Composite CO  :     9.21    0.331    0.195
    Composite NOX :    0.265    0.791    0.475
    Composite CO2 :   1375.0   2334.1   1646.7
-----------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2030 35 mph - Summer
* File 1, Run 1, Scenario 8.
* # # # # # # # # # # # # # # # # # # # # # # # # #

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M583 Warning:
          The user supplied arterial average speed of 35.0
          will be used for all hours of the day. 100% of VMT
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
         there are no sales for vehicle class HDGV8b
 M 48 Warning:
         there are no sales for vehicle class LDDV

 LEV phase-in data read from file MA_LEV2.D
               Calendar Year:  2030
                    Month:  July
                  Altitude:  Low
         Minimum Temperature:  70.4 (F)
         Maximum Temperature:  93.7 (F)
          Absolute Humidity:   75. grains/lb
         Fuel Sulfur Content:   30. ppm

         Exhaust I/M Program:  Yes
           Evap I/M Program:  Yes
              ATP Program:  No
           Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:             <6000    >6000    (All)
                    ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607    0.4379   0.1723            0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
 Fuel Economy (mpg):      24.1      18.5      14.2      17.0       9.9       0.0      18.4       7.3      50.0      16.0
 ------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     0.162    0.164    0.186    0.170    0.167    0.000    0.056    0.210     2.86    0.181
    Composite CO  :      3.05     3.26     3.38     3.30     3.97    0.000    0.243    0.181    12.91    3.018
    Composite NOX :     0.103    0.116    0.150    0.125    0.163    0.000    0.033    0.448     1.22    0.153
    Composite CO2 :     368.0    479.4    624.6    520.4    894.5      0.0    552.2   1398.5    177.4   569.40
 ------------------------------------------------------------------------------------------------------------
       Veh. Type:    GasBUS    URBAN    SCHOOL
                     ------    ------   ------
        VMT Mix:    0.0004    0.0009    0.0014
 Fuel Economy (mpg):       6.4       4.4       6.2
-------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     0.285    0.210    0.251
    Composite CO  :      8.07    0.286    0.169
    Composite NOX :     0.276    0.784    0.470
    Composite CO2 :    1375.0   2334.1   1646.7
-------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2030 50 mph - Summer
* File 1, Run 1, Scenario 9.
* # # # # # # # # # # # # # # # # # # # # # # # # #

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
* from the external data file PMDDR2.CSV
 M583 Warning:
         The user supplied arterial average speed of 50.0
         will be used for all hours of the day. 100% of VMT
         has been assigned to the arterial/collector roadway
         type for all hours of the day and all vehicle types.
 M 48 Warning:
          there are no sales for vehicle class HDGV8b
 M 48 Warning:
          there are no sales for vehicle class LDDV

 LEV phase-in data read from file MA_LEV2.D
               Calendar Year:  2030
                      Month:  July
                   Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
           Absolute Humidity:   75. grains/lb
          Fuel Sulfur Content:   30. ppm

          Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
                ATP Program:  No
            Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
           GVWR:            <6000    >6000    (All)
                   ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607   0.4379   0.1723            0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
 Fuel Economy (mpg):     24.1     18.5     14.2     17.0      9.9      0.0     18.4      7.3     50.0     16.0
 ------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :    0.144    0.152    0.175    0.158    0.135    0.000    0.046    0.161     2.66    0.163
    Composite CO  :     3.57     3.82     3.96     3.86     3.71    0.000    0.219    0.154    10.68    3.478
    Composite NOX :    0.106    0.124    0.159    0.134    0.182    0.000    0.040    0.539     1.34    0.168
    Composite CO2 :    368.0    479.4    624.6    520.4    894.5      0.0    552.2   1398.5    177.4   569.40
 ------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN   SCHOOL
                   ------   ------   ------
         VMT Mix:   0.0004   0.0009   0.0014
 Fuel Economy (mpg):      6.4      4.4      6.2
------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :    0.248    0.161    0.193
    Composite CO  :     7.54    0.244    0.144
    Composite NOX :    0.308    0.944    0.566
    Composite CO2 :   1375.0   2334.1   1646.7
------------------------------------------------------------------------------------------------------------
*****************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                                *
* Input file: MA30_ALL.INP (file 1, run 1). *
*****************************************************************************

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2030 Idle Scenario - Summer (multiply g/mi by 2.5 mph to get g/hr)
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                     Calendar Year:  2030
                            Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
            Diesel Fuel Sulfur Content:   15. ppm
                Particle Size Cutoff: 10.00 Microns
                    Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
            GVWR:             <6000    >6000    (All)
                   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607   0.4379   0.1723            0.0375   0.0000   0.0015   0.0864   0.0036    1.0000
-----------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
            Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
           GASPM:   0.0037   0.0036   0.0036   0.0036   0.0088   ------   ------   ------   0.0205   0.0036
         ECARBON:   ------   ------   ------   ------   ------   0.0000   0.0037   0.0090   ------   0.0008
         OCARBON:   ------   ------   ------   ------   ------   0.0000   0.0053   0.0046   ------   0.0004
             SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0000   0.0003   0.0009   0.0002   0.0006
  Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0207   0.0054
           Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
            Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
        Total PM:   0.0247   0.0247   0.0247   0.0247   0.0312   0.0000   0.0299   0.0520   0.0372   0.0274
             SO2:   0.0064   0.0087   0.0115   0.0095   0.0163   0.0000   0.0052   0.0130   0.0033   0.0092
             NH3:   0.0994   0.1012   0.1017   0.1013   0.0451   0.0000   0.0068   0.0270   0.0113   0.0918
-----------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                    ------   ------   ------
         VMT Mix:   0.0004   0.0009   0.0014
-----------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
            Lead:   0.0000   ------   ------
           GASPM:   0.0147   ------   ------
         ECARBON:   ------   0.0137   0.0128
         OCARBON:   ------   0.0108   0.0100
             SO4:   0.0014   0.0015   0.0011
  Total Exhaust PM:   0.0161   0.0260   0.0239
           Brake:   0.0125   0.0125   0.0125
            Tire:   0.0120   0.0120   0.0120
        Total PM:   0.0406   0.0505   0.0484
             SO2:   0.0253   0.0217   0.0153
             NH3:   0.0451   0.0270   0.0270
-----------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2030 5 mph - Summer
* File 1, Run 1, Scenario 2.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                  Calendar Year:  2030
                          Month:  July
      Gasoline Fuel Sulfur Content:   30. ppm
        Diesel Fuel Sulfur Content:   15. ppm
            Particle Size Cutoff: 10.00 Microns
               Reformulated Gas:  Yes

    Vehicle Type:     LDGV    LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
            GVWR:             <6000    >6000    (All)
                   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607   0.4379   0.1723            0.0375   0.0000   0.0015   0.0864   0.0036    1.0000
-----------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
            Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
           GASPM:   0.0037   0.0036   0.0036   0.0036   0.0088   ------   ------   ------   0.0205   0.0036
         ECARBON:   ------   ------   ------   ------   ------   0.0000   0.0037   0.0090   ------   0.0008
         OCARBON:   ------   ------   ------   ------   ------   0.0000   0.0053   0.0046   ------   0.0004
             SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0000   0.0003   0.0009   0.0002   0.0006
  Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0207   0.0054
           Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
            Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
        Total PM:   0.0247   0.0247   0.0247   0.0247   0.0312   0.0000   0.0299   0.0520   0.0372   0.0274
             SO2:   0.0064   0.0087   0.0115   0.0095   0.0163   0.0000   0.0052   0.0130   0.0033   0.0092
             NH3:   0.0994   0.1012   0.1017   0.1013   0.0451   0.0000   0.0068   0.0270   0.0113   0.0918
-----------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
            ------  ------  ------
      VMT Mix:  0.0004  0.0009  0.0014
----------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:  0.0000  ------  ------
          GASPM:  0.0147  ------  ------
        ECARBON:  ------  0.0137  0.0128
        OCARBON:  ------  0.0108  0.0100
            SO4:  0.0014  0.0015  0.0011
 Total Exhaust PM:  0.0161  0.0260  0.0239
          Brake:  0.0125  0.0125  0.0125
           Tire:  0.0120  0.0120  0.0120
       Total PM:  0.0406  0.0505  0.0484
            SO2:  0.0253  0.0217  0.0153
            NH3:  0.0451  0.0270  0.0270
----------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2030 10 mph - Summer
* File 1, Run 1, Scenario 3.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                        Calendar Year:  2030
                               Month:  July
           Gasoline Fuel Sulfur Content:   30. ppm
             Diesel Fuel Sulfur Content:   15. ppm
                Particle Size Cutoff: 10.00 Microns
                   Reformulated Gas:  Yes

    Vehicle Type:   LDGV   LDGT12  LDGT34   LDGT    HDGV    LDDV    LDDT    HDDV     MC  All Veh
          GVWR:            <6000   >6000    (All)
                  ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
 VMT Distribution:  0.2607  0.4379  0.1723          0.0375  0.0000  0.0015  0.0864  0.0036  1.0000
----------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:  0.0000  0.0000  0.0000  0.0000  0.0000  ------  ------  ------  0.0000  0.0000
          GASPM:  0.0037  0.0036  0.0036  0.0036  0.0088  ------  ------  ------  0.0205  0.0036
        ECARBON:  ------  ------  ------  ------  ------  0.0000  0.0037  0.0090  ------  0.0008
        OCARBON:  ------  ------  ------  ------  ------  0.0000  0.0053  0.0046  ------  0.0004
            SO4:  0.0005  0.0006  0.0006  0.0006  0.0013  0.0000  0.0003  0.0009  0.0002  0.0006
 Total Exhaust PM:  0.0042  0.0042  0.0042  0.0042  0.0102  0.0000  0.0093  0.0146  0.0207  0.0054
          Brake:  0.0125  0.0125  0.0125  0.0125  0.0125  0.0000  0.0125  0.0125  0.0125  0.0125
           Tire:  0.0080  0.0080  0.0080  0.0080  0.0085  0.0000  0.0080  0.0248  0.0040  0.0095
       Total PM:  0.0247  0.0247  0.0247  0.0247  0.0312  0.0000  0.0299  0.0520  0.0372  0.0274
            SO2:  0.0064  0.0087  0.0115  0.0095  0.0163  0.0000  0.0052  0.0130  0.0033  0.0092
            NH3:  0.0994  0.1012  0.1017  0.1013  0.0451  0.0000  0.0068  0.0270  0.0113  0.0918
----------------------------------------------------------------------------------------------------------------------------
     Veh. Type:  GasBUS   URBAN   SCHOOL
                 ------  ------  ------
      VMT Mix:  0.0004  0.0009  0.0014
----------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:  0.0000  ------  ------
          GASPM:  0.0147  ------  ------
        ECARBON:  ------  0.0137  0.0128
        OCARBON:  ------  0.0108  0.0100
            SO4:  0.0014  0.0015  0.0011
 Total Exhaust PM:  0.0161  0.0260  0.0239
          Brake:  0.0125  0.0125  0.0125
           Tire:  0.0120  0.0120  0.0120
       Total PM:  0.0406  0.0505  0.0484
            SO2:  0.0253  0.0217  0.0153
            NH3:  0.0451  0.0270  0.0270
----------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
* 2030 15 mph - Summer
* File 1, Run 1, Scenario 4.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year:  2030
                           Month:  July
         Gasoline Fuel Sulfur Content:   30. ppm
           Diesel Fuel Sulfur Content:   15. ppm
                Particle Size Cutoff: 10.00 Microns
                     Reformulated Gas:  Yes

    Vehicle Type:    LDGV   LDGT12   LDGT34    LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
         GVWR:               <6000    >6000    (All)
                    ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
 VMT Distribution:  0.2607   0.4379   0.1723            0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
-----------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
         GASPM:   0.0037   0.0036   0.0036   0.0036   0.0088   ------   ------   ------   0.0205   0.0036
      ECARBON:   ------   ------   ------   ------   ------   0.0000   0.0037   0.0090   ------   0.0008
      OCARBON:   ------   ------   ------   ------   ------   0.0000   0.0053   0.0046   ------   0.0004
           SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0000   0.0003   0.0009   0.0002   0.0006
 Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0207   0.0054
         Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
          Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
      Total PM:   0.0247   0.0247   0.0247   0.0247   0.0312   0.0000   0.0299   0.0520   0.0372   0.0274
           SO2:   0.0064   0.0087   0.0115   0.0095   0.0163   0.0000   0.0052   0.0130   0.0033   0.0092
           NH3:   0.0994   0.1012   0.1017   0.1013   0.0451   0.0000   0.0068   0.0270   0.0113   0.0918
-----------------------------------------------------------------------------------------------------------
      Veh. Type:   GasBUS    URBAN   SCHOOL
                   ------   ------   ------
        VMT Mix:   0.0004   0.0009   0.0014
-----------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   ------   ------
         GASPM:   0.0147   ------   ------
      ECARBON:   ------   0.0137   0.0128
      OCARBON:   ------   0.0108   0.0100
           SO4:   0.0014   0.0015   0.0011
 Total Exhaust PM:   0.0161   0.0260   0.0239
         Brake:   0.0125   0.0125   0.0125
          Tire:   0.0120   0.0120   0.0120
      Total PM:   0.0406   0.0505   0.0484
           SO2:   0.0253   0.0217   0.0153
           NH3:   0.0451   0.0270   0.0270
-----------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2030 20 mph - Summer
* File 1, Run 1, Scenario 5.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                    Calendar Year:  2030
                           Month:  July
         Gasoline Fuel Sulfur Content:   30. ppm
           Diesel Fuel Sulfur Content:   15. ppm
                Particle Size Cutoff: 10.00 Microns
                     Reformulated Gas:  Yes

    Vehicle Type:    LDGV   LDGT12   LDGT34    LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
         GVWR:               <6000    >6000    (All)
                    ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
 VMT Distribution:  0.2607   0.4379   0.1723            0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
-----------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
          GASPM:  0.0037  0.0036  0.0036  0.0036  0.0088  ------  ------  ------  0.0205  0.0036
        ECARBON:  ------  ------  ------  ------  ------  0.0000  0.0037  0.0090  ------  0.0008
        OCARBON:  ------  ------  ------  ------  ------  0.0000  0.0053  0.0046  ------  0.0004
            SO4:  0.0005  0.0006  0.0006  0.0006  0.0014  0.0000  0.0003  0.0009  0.0002  0.0006
 Total Exhaust PM:  0.0042  0.0042  0.0042  0.0042  0.0102  0.0000  0.0093  0.0146  0.0207  0.0054
          Brake:  0.0125  0.0125  0.0125  0.0125  0.0125  0.0000  0.0125  0.0125  0.0125  0.0125
           Tire:  0.0080  0.0080  0.0080  0.0080  0.0085  0.0000  0.0080  0.0248  0.0040  0.0095
       Total PM:  0.0247  0.0247  0.0247  0.0247  0.0312  0.0000  0.0299  0.0520  0.0372  0.0274
            SO2:  0.0064  0.0087  0.0115  0.0095  0.0163  0.0000  0.0052  0.0130  0.0033  0.0092
            NH3:  0.0994  0.1012  0.1017  0.1013  0.0451  0.0000  0.0068  0.0270  0.0113  0.0918
---------------------------------------------------------------------------------------------------
      Veh. Type:  GasBUS  URBAN  SCHOOL
                  ------  ------  ------
        VMT Mix:  0.0004  0.0009  0.0014
---------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:  0.0000  ------  ------
          GASPM:  0.0146  ------  ------
        ECARBON:  ------  0.0137  0.0128
        OCARBON:  ------  0.0108  0.0100
            SO4:  0.0014  0.0015  0.0011
 Total Exhaust PM:  0.0161  0.0260  0.0239
          Brake:  0.0125  0.0125  0.0125
           Tire:  0.0120  0.0120  0.0120
       Total PM:  0.0406  0.0505  0.0484
            SO2:  0.0253  0.0217  0.0153
            NH3:  0.0451  0.0270  0.0270
---------------------------------------------------------------------------------------------------
* ##########################
* 2030 25 mph - Summer
* File 1, Run 1, Scenario 6.
* #########################

                    Calendar Year:  2030
                            Month:  July
      Gasoline Fuel Sulfur Content:  30. ppm
        Diesel Fuel Sulfur Content:  15. ppm
              Particle Size Cutoff: 10.00 Microns
                  Reformulated Gas:  Yes

    Vehicle Type:   LDGV   LDGT12  LDGT34   LDGT    HDGV    LDDV    LDDT    HDDV     MC  All Veh
            GVWR:          <6000   >6000    (All)
                  ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
 VMT Distribution:  0.2607  0.4379  0.1723          0.0375  0.0000  0.0015  0.0864  0.0036  1.0000
---------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:  0.0000  0.0000  0.0000  0.0000  0.0000  ------  ------  ------  0.0000  0.0000
          GASPM:  0.0038  0.0037  0.0037  0.0037  0.0086  ------  ------  ------  0.0205  0.0036
        ECARBON:  ------  ------  ------  ------  ------  0.0000  0.0037  0.0090  ------  0.0008
        OCARBON:  ------  ------  ------  ------  ------  0.0000  0.0053  0.0046  ------  0.0004
            SO4:  0.0004  0.0005  0.0005  0.0005  0.0016  0.0000  0.0003  0.0009  0.0001  0.0006
 Total Exhaust PM:  0.0042  0.0042  0.0042  0.0042  0.0102  0.0000  0.0093  0.0146  0.0206  0.0054
          Brake:  0.0125  0.0125  0.0125  0.0125  0.0125  0.0000  0.0125  0.0125  0.0125  0.0125
           Tire:  0.0080  0.0080  0.0080  0.0080  0.0085  0.0000  0.0080  0.0248  0.0040  0.0095
       Total PM:  0.0247  0.0247  0.0247  0.0247  0.0313  0.0000  0.0299  0.0520  0.0372  0.0274
            SO2:  0.0065  0.0087  0.0115  0.0095  0.0162  0.0000  0.0052  0.0130  0.0033  0.0092
            NH3:  0.0994  0.1012  0.1017  0.1013  0.0451  0.0000  0.0068  0.0270  0.0113  0.0918
---------------------------------------------------------------------------------------------------
      Veh. Type:  GasBUS  URBAN  SCHOOL
                  ------  ------  ------
        VMT Mix:  0.0004  0.0009  0.0014
---------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:  0.0000  ------  ------
          GASPM:  0.0144  ------  ------
        ECARBON:  ------  0.0137  0.0128
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
        OCARBON:   ------   0.0108   0.0100
            SO4:   0.0016   0.0015   0.0011
Total Exhaust PM:   0.0161   0.0260   0.0239
          Brake:   0.0125   0.0125   0.0125
           Tire:   0.0120   0.0120   0.0120
       Total PM:   0.0406   0.0505   0.0484
            SO2:   0.0252   0.0217   0.0153
            NH3:   0.0451   0.0270   0.0270
-------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2030 30 mph - Summer
* File 1, Run 1, Scenario 7.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                  Calendar Year:  2030
                          Month:  July
     Gasoline Fuel Sulfur Content:   30. ppm
       Diesel Fuel Sulfur Content:   15. ppm
           Particle Size Cutoff: 10.00 Microns
              Reformulated Gas:  Yes

   Vehicle Type:    LDGV   LDGT12   LDGT34    LDGT    HDGV    LDDV    LDDT    HDDV      MC   All Veh
           GVWR:             <6000    >6000    (All)
                  ------   ------   ------   ------   ------   ------   ------   ------   ------
VMT Distribution:   0.2607   0.4379   0.1723            0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
-------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0039   0.0037   0.0037   0.0037   0.0083   ------   ------   ------   0.0205   0.0037
        ECARBON:   ------   ------   ------   ------   ------   0.0000   0.0037   0.0090   ------   0.0008
        OCARBON:   ------   ------   ------   ------   ------   0.0000   0.0053   0.0046   ------   0.0004
            SO4:   0.0003   0.0005   0.0005   0.0005   0.0019   0.0000   0.0003   0.0009   0.0001   0.0005
Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0206   0.0054
          Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
           Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
       Total PM:   0.0247   0.0247   0.0247   0.0247   0.0313   0.0000   0.0299   0.0520   0.0371   0.0274
            SO2:   0.0065   0.0087   0.0115   0.0095   0.0162   0.0000   0.0052   0.0130   0.0033   0.0092
            NH3:   0.0994   0.1012   0.1017   0.1013   0.0451   0.0000   0.0068   0.0270   0.0113   0.0918
-------------------------------------------------------------------------------
      Veh. Type:   GasBUS    URBAN   SCHOOL
                   ------   ------   ------
        VMT Mix:   0.0004   0.0009   0.0014
-------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
           Lead:   0.0000   ------   ------
          GASPM:   0.0142   ------   ------
        ECARBON:   ------   0.0137   0.0128
        OCARBON:   ------   0.0108   0.0100
            SO4:   0.0019   0.0015   0.0011
Total Exhaust PM:   0.0161   0.0260   0.0239
          Brake:   0.0125   0.0125   0.0125
           Tire:   0.0120   0.0120   0.0120
       Total PM:   0.0406   0.0505   0.0484
            SO2:   0.0251   0.0217   0.0153
            NH3:   0.0451   0.0270   0.0270
-------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* 2030 35 mph - Summer
* File 1, Run 1, Scenario 8.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                  Calendar Year:  2030
                          Month:  July
     Gasoline Fuel Sulfur Content:   30. ppm
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
            Diesel Fuel Sulfur Content:   15. ppm
              Particle Size Cutoff: 10.00 Microns
                Reformulated Gas:  Yes

   Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
         GVWR:              <6000    >6000    (All)
                  ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
 VMT Distribution:   0.2607   0.4379   0.1723             0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
-----------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
         GASPM:   0.0040   0.0038   0.0038   0.0038   0.0081   ------   ------   ------   0.0205   0.0037
       ECARBON:   ------   ------   ------   ------   ------   0.0000   0.0037   0.0090   ------   0.0008
       OCARBON:   ------   ------   ------   ------   ------   0.0000   0.0053   0.0046   ------   0.0004
           SO4:   0.0002   0.0004   0.0004   0.0004   0.0021   0.0000   0.0003   0.0009   0.0001   0.0005
 Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0206   0.0054
         Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
          Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
      Total PM:   0.0247   0.0247   0.0247   0.0247   0.0313   0.0000   0.0299   0.0520   0.0371   0.0274
           SO2:   0.0065   0.0087   0.0115   0.0095   0.0161   0.0000   0.0052   0.0130   0.0033   0.0093
           NH3:   0.0994   0.1012   0.1017   0.1013   0.0451   0.0000   0.0068   0.0270   0.0113   0.0918
-----------------------------------------------------------------------------------------------------------
      Veh. Type:    GasBUS    URBAN    SCHOOL
                  ------   ------   ------
       VMT Mix:   0.0004   0.0009   0.0014
-----------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   ------   ------
         GASPM:   0.0139   ------   ------
       ECARBON:   ------   0.0137   0.0128
       OCARBON:   ------   0.0108   0.0100
           SO4:   0.0021   0.0015   0.0011
 Total Exhaust PM:   0.0161   0.0260   0.0239
         Brake:   0.0125   0.0125   0.0125
          Tire:   0.0120   0.0120   0.0120
      Total PM:   0.0406   0.0505   0.0484
           SO2:   0.0251   0.0217   0.0153
           NH3:   0.0451   0.0270   0.0270
-----------------------------------------------------------------------------------------------------------
* #########################
* 2030 50 mph - Summer
* File 1, Run 1, Scenario 9.
* #########################

                   Calendar Year:  2030
                        Month:  July
        Gasoline Fuel Sulfur Content:   30. ppm
            Diesel Fuel Sulfur Content:   15. ppm
              Particle Size Cutoff: 10.00 Microns
                Reformulated Gas:  Yes

   Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
         GVWR:              <6000    >6000    (All)
                  ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
 VMT Distribution:   0.2607   0.4379   0.1723             0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
-----------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
         GASPM:   0.0040   0.0038   0.0038   0.0038   0.0081   ------   ------   ------   0.0205   0.0037
       ECARBON:   ------   ------   ------   ------   ------   0.0000   0.0037   0.0090   ------   0.0008
       OCARBON:   ------   ------   ------   ------   ------   0.0000   0.0053   0.0046   ------   0.0004
           SO4:   0.0002   0.0004   0.0004   0.0004   0.0021   0.0000   0.0003   0.0009   0.0001   0.0005
 Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0206   0.0054
         Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
          Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
      Total PM:   0.0247   0.0247   0.0247   0.0247   0.0313   0.0000   0.0299   0.0520   0.0371   0.0274
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
          SO2:  0.0065  0.0087  0.0115  0.0095  0.0161  0.0000  0.0052  0.0130  0.0033  0.0093
          NH3:  0.0994  0.1012  0.1017  0.1013  0.0451  0.0000  0.0068  0.0270  0.0113  0.0918
-------------------------------------------------------------------------------------------------
     Veh. Type:   GasBUS   URBAN   SCHOOL
                  ------   ------  ------
      VMT Mix:    0.0004   0.0009  0.0014
-------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
         Lead:  0.0000   ------   ------
        GASPM:  0.0139   ------   ------
      ECARBON:  ------   0.0137   0.0128
      OCARBON:  ------   0.0108   0.0100
          SO4:  0.0021   0.0015   0.0011
 Total Exhaust PM:  0.0161   0.0260   0.0239
        Brake:  0.0125   0.0125   0.0125
         Tire:  0.0120   0.0120   0.0120
     Total PM:  0.0406   0.0505   0.0484
          SO2:  0.0251   0.0217   0.0153
          NH3:  0.0451   0.0270   0.0270
-------------------------------------------------------------------------------------------------
```

Source: KBE and Massport.

Fuel Storage and Handling

As in previous years, VOC emissions from fuel storage and handling were calculated using methods based on EPA's AP-42[2] document. Calculations account for evaporative emissions from breathing losses, working losses, and spillage from aboveground storage tanks, underground storage tanks, and aircraft refueling. In 2003, additional information became available on the fire training fuel, Tek-Flame®. Emissions of VOCs from this fuel were estimated by EDMS. Table I-11 presents Logan Airport's fuel throughput by category.

Stationary Sources

Stationary sources include the Central Heating and Cooling Plant, emergency generators, snow melters, and boilers. Emission factors from EPA's AP-42 or NO_x Reasonably Available Control Technology (RACT) compliance testing were combined with the actual 2011 fuel throughput of the stationary sources to obtain emissions of VOCs, NO_X, CO, and PM with a diameter of less than or equal to 10 micrograms or 2.5 micrograms (PM_{10}/$PM_{2.5}$).

Title V of the 1990 Clean Air Act (CAA) Amendments requires facilities with air emissions to document their emissions and obtain a single permit combining all sources. The permitting program ensures that all emission sources are accounted for, the proper permits have been received, and permit conditions are being followed. A Title V Air Operating Permit covers all of the stationary sources at Logan Airport including boilers, emergency generators, snow melters, fire training, cooling towers, paint booths, deicing facilities, and storage tanks. Table I-12 presents Logan Airport's stationary source fuel throughput by fuel category.

2 Compilation of Air Pollutant Emission Factors, AP-42, Office of Air Quality Planning and Standards, EPA, Fifth Edition,1995.

Table I-11 Fuel Throughput by Fuel Category (gallons)

Fuel Category	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Jet Fuel	354,095,516	441,901,932	416,748,819	358,190,362	319,439,910	373,996,141	368,645,392	364,450,864	367,585,187	345,631,788	327,358,619	335,693,997	**340,421,373**
Fire Training Fuel[1]	NA	NA	NA	NA	13,719	12,227	8,105	5,000	8,631	5,971	3,510	800	**3,810**
Aviation Gas	99,726	90,922	60,691	35,111	32,515	34,717	52,487	35,098	29,067	25,037	18,238	15,268	**14,064**
Auto Gas	7,200,000	7,569,206	6,181,472	5,754,740	5,436,322	5,803,442	5,903,424	6,028,931	6,022,237	5,693,178	5,736,724	5,696,505	**5,487,952**
Diesel	768,106	839,751	1,239,904	1,067,847	1,030,185	1,078,665	1,567,688	1,164,493	1,141,335	1,071,707	1,121,241	1,168,761	**1,099,720**
Heating Oil No.2	480,733	494,500	582,283	340,492	370,903	381,852	367,899	259,768	423,181	303,143	409,049	319,727	**18,727**
Heating Oil No.6	1,600,893	1,555,527	1,641,693	1,079,283	1,122,975	2,940,752	3,098,126	1,396,529	1,073,260	16,385	368,690	9,010	**0**

Source: Massport, 2012.
1 Fire Training Fuel used in 1999-2002 was Jet A Fuel while in 2003 through 2011 it was Tek-Flame®. 2011 includes 310 gallons of avgas.
NA Not available.

Table I-12 Stationary Source Fuel Throughput by Fuel Category (gallons)

Fuel Category	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Natural Gas (ft^3)	183,943,000	283,720,049	199,500,000	268,359,282	201,714,114	62,610,000	92,460,000	112,390,000	338,430,000	458,680,000	430,810,000	449,640,000	479,830,000
Heating Oil No. 2	480,733	494,500	582,283	340,492	370,903	381,852	367,899	259,768	423,181	303,143	409,050	319,727	384,906
Heating Oil No. 6	1,600,893	1,555,527	1,641,693	1,079,283	1,122,975	2,940,752	3,098,126	1,396,529	1,073,260	16,385	368,690	9,010	11,285
Diesel Fuel[1]	57,441	NA	NA	NA	NA	67,198	77,848	77,848	258,606	146,718	145,778	116,511	218,081
Fire Training Fuel[2]	23,000	NA	NA	NA	13,719	12,227	8,105	5,000	8,631	5,971	3,510	800	3,810

Source: Massport, 2012.
NA Not available.
1 Diesel fuel was from the stationary snow melter usage. Starting in 2007, portable snow melter usage was also included.
2 Fire Training Fuel used in 1999-2002 was Jet A Fuel while in 2003 through 2011 it was Tek-Flame®. 2011 includes 310 gallons of avgas.

1993 Through 1999 Emissions Inventories

Tables I-13 through I-15 contain the 1993 through 1999 Emissions Inventory summary tables for Logan Airport.

Table I-13 Estimated Volatile Organic Compounds (VOC) Emissions (in kg/day) at Logan Airport[1]

	1993	1994	1995	1996	1997	1998	1999[2]
Aircraft/GSE Model	**Logan Dispersion Modeling System (LDMS)**					**EDMS v3.22**	**EDMS v4.21**
Motor Vehicle Model	**MOBILE5a**					**MOB5a_h**	**MOB6.2.03**
Aircraft Sources							
Air carriers	1,958	1,554	1,407	1,390	1,227	736	653
Commuter aircraft	943	543	531	622	498	154	196
Cargo aircraft	89	244	236	214	207	43	318
General aviation	51	48	36	24	27	13	141
Total aircraft sources	3,041	2,389	2,210	2,250	1,959	946	1,308
Ground Service Equipment[3]	636	533	521	497	530	145	243
Motor Vehicles							
Ted Williams Tunnel through-traffic	NA	NA	NA	NA	NA	NA	15
Parking/curbside	173	148	127	102	102	118	101
On-airport vehicles[4]	238	215	179	223	205	258	256
Total motor vehicle sources	411	363	306	325	307	376	372
Other Sources							
Fuel storage/handling	408	434	318	356	381	372	352
Miscellaneous sources[5]	5	5	5	6	6	2	16
Total other sources	413	439	323	362	387	374	368
Total Airport Sources	4,501	3,724	3,360	3,434	3,183	1,841	2,291

Source: KBE.
Notes:
kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).
NA Not available.
MOB MOBILE model for motor vehicle emissions (MOB5a_h=MOBILE5a_h, MOB6.2.03=MOBILE6.2 version .03)
1 The emissions inventory for 1990 is shown in the 2005 EDR. Emission inventories for 1991 and 1992 were not prepared.
2 Year 1999 emissions were last re-calculated using EDMS v4.21 in the 2004 ESPR Air Quality Analysis.
3 Beginning in 1996 and later, emissions include vehicles and equipment converted to alternative fuels. APU emissions are also included.
4 1999 emissions inventory include reductions attributable to CNG shuttle buses.
5 Includes the Central Heating and Cooling Plant, emergency electricity generation, and other stationary sources. Fire Training emissions were included in 1999. Diesel snow melter usage was added in 1999.

Table I-14 Estimated Nitrogen Oxides (NO_X) Emissions (in kg/day) at Logan Airport[1]

	1993	1994	1995	1996	1997	1998	1999[2]
Aircraft/GSE Model	**Logan Dispersion Modeling System (LDMS)**					**EDMS v3.22**	**EDMS v4.21**
Motor Vehicle Model	**MOBILE5a**					**MOB5a_h**	**MOB6.2.03**
Aircraft Sources							
Air carriers	4,271	4,317	3,861	3,781	4,150	4,471	4,183
Commuter aircraft	202	158	192	137	159	203	166
Cargo aircraft	213	257	332	363	262	254	286
General aviation	13	13	17	18	21	5	12
Total aircraft sources	4,699	4,745	4,402	4,299	4,592	4,933	4,647
Ground Service Equipment[3]	722	617	607	588	622	317	444
Motor Vehicles							
Ted Williams Tunnel through-traffic	NA	NA	NA	NA	NA	NA	28
Parking/curbside	25	24	24	24	24	37	39
On-airport vehicles[4]	240	239	229	257	244	372	449
Total motor vehicle sources	265	263	253	281	268	409	516
Other Sources							
Fuel storage/handling[5]	0	0	0	0	0	0	0
Miscellaneous sources[6]	278	330	320	275	244	284	165
Total other sources	278	330	320	275	244	284	165
Total Airport Sources	5,964	5,955	5,582	5,443	5,726	5,943	5,772

Source: KBE.
Notes:
kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).
NA Not available.
MOB MOBILE model for motor vehicle emissions (MOB5a_h=MOBILE5a_h, MOB6.2.03=MOBILE6.2 version .03)
1 The emissions inventory for 1990 is shown in the 2005 EDR. Emission inventories for 1991 and 1992 were not prepared.
2 Year 1999 emissions were last re-calculated using EDMS v4.21 in the 2004 ESPR Air Quality Analysis.
3 Beginning in 1996 and later, emissions include vehicles and equipment converted to alternative fuels. APU emissions are also included.
4 1999 emissions inventory include reductions attributable to CNG shuttle buses.
5 Fuel storage and handling facilities are not sources of NOx emissions.
6 Includes the Central Heating and Cooling Plant, emergency electricity generation, and other stationary sources. Fire Training emissions were included in 1999. Diesel snow melter usage was added in 1999.

Table I-15 Estimated Carbon Monoxide (CO) Emissions (in kg/day) at Logan Airport[1]

	1993	1994	1995	1996	1997	1998	1999[2]
Aircraft/GSE Model	**Logan Dispersion Modeling System (LDMS)**					**EDMS v3.22**	**EDMS v4.21**
Motor Vehicle Model	**MOBILE5a**					**MOB5a_h**	**MOB6.2.03**
Aircraft Sources							
Air carriers	5,663	4,660	4,691	4,812	4,698	3,079	3,754
Commuter aircraft	1,309	927	934	859	770	482	1,404
Cargo aircraft	344	572	598	580	514	218	503
General aviation	353	356	339	549	654	269	940
Total aircraft sources	7,669	6,515	6,562	6,800	6,636	4,048	6,601
Ground Service Equipment[3]	7,482	6,187	6,029	5,740	6,098	5,113	4,532
Motor Vehicles							
Ted Williams Tunnel through-traffic	NA	NA	NA	NA	NA	NA	151
Parking/curbside	952	820	650	644	586	772	437
On-airport vehicles[4]	1,575	1,451	1,087	1,514	1,283	1,883	2,547
Total motor vehicle sources	2,527	2,271	1,737	2,158	1,869	2,655	3,135
Other Sources							
Fuel storage/handling[5]	0	0	0	0	0	0	0
Miscellaneous sources[6]	26	30	29	39	37	37	168
Total other sources	26	30	29	39	37	37	168
Total Airport Sources	17,704	15,003	14,357	14,737	14,640	11,853	14,436

Source: KBE.
Notes:
kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).
NA Not available.
MOB MOBILE model for motor vehicle emissions (MOB5a_h=MOBILE5a_h, MOB6.2.03=MOBILE6.2 version .03)
1 The emissions inventory for 1990 is shown in the 2005 EDR. Emission inventories for 1991 and 1992 were not prepared.
2 Year 1999 emissions were last re-calculated using EDMS v4.21 in the 2004 ESPR Air Quality Analysis.
3 Beginning in 1996 and later, emissions include vehicles and equipment converted to alternative fuels. APU emissions are also included.
4 1999 emission inventory include reductions attributable to CNG shuttle buses.
5 Fuel storage and handling facilities are not sources of CO emissions.
6 Includes the Central Heating and Cooling Plant, emergency electricity generation, and other stationary sources. Fire Training emissions were included in 1999. Diesel snow melter usage was added in 1999.

Greenhouse Gas Emissions Inventory for 2011

The Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) has published the *MEPA Greenhouse Gas Emissions Policy and Protocol*.[3] These guidelines require that certain projects undergoing review under the Massachusetts Environmental Policy Act (MEPA) quantify the greenhouse gas (GHG) emissions generated by proposed projects, and identify measures to avoid, minimize, or mitigate such emissions.[4] Even though the *2011 ESPR* does not assess any proposed projects and is therefore not subject to the GHG policy, Massport has voluntarily prepared an emission inventory of GHG emissions directly and indirectly associated with Logan Airport.

In April 2009, the Transportation Research Board Airport Cooperative Research Program (ACRP); published the *Guidebook on Preparing Airport Greenhouse Gas Emission Inventories (ACRP Report 11)*, which provides recommended instructions to airport operators on how to prepare an airport-specific GHG emissions inventory.[5] The 2011 GHG emissions estimates include aircraft (within the ground taxi/delay and up to 3,000 feet), GSE, APU, motor vehicles, a variety of stationary sources, and electricity usage. Aircraft cruise emissions over the 3,000-foot level were not included. This work was accomplished following the EEA guidelines and uses widely-accepted emission factors that are considered appropriate for this application, including International Organization for Standardization New England electricity-based values.

Methodology

Airport GHG emissions are calculated in much the same way as criteria pollutants,[6] through the use of input data such as activity levels or material throughput rates (i.e., fuel usage, VMT, electrical consumption) that are applied to appropriate emission factors (i.e., in units of GHG emissions per gallon of fuel).

In this case, the input data were either based on Massport records, or data and information derived from the latest version of the FAA EDMS Version 5.1.3. Table I-16 summarizes these data and information used in the 2011 GHG inventory.

Massport will update the GHG Emissions Inventory for Logan Airport annually.

3 Revised *MEPA Greenhouse Gas Emissions Policy and Protocol*, Massachusetts Executive Office of Energy and Environmental Affairs, effective May 10, 2010.

4 These GHG are comprised primarily of carbon dioxide (CO_2), methane (CH_4), nitrous oxides (N_2O), and three groups of fluorinated gases (i.e., sulfur hexafluoride [SF_6], hydrofluorocarbons [HFCs], and perfluorocarbons [PFCs]). GHG emission sources associated with airports are generally limited to CO_2, CH_4, and N_2O.

5 Transportation Research Board, Airport Cooperative Research Panel, ACRP Report 11, Project 02-06, *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories* (in production). See http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_011.pdf for the full report.

6 Criteria pollutants are pollutants for which there are National Ambient Air Quality Standards (i.e., carbon monoxide, sulfur dioxide, nitrogen dioxide, etc.).

Table I-16 Logan Airport Greenhouse Gas (GHG) Inventory Input Data and Information[1] for 2011

Activity	Fuel Type	Usage	Units	Source
Aircraft				
Aircraft Taxi	Jet A[2]	19,550,164	gallons	EDMS v5.1.3
	AvGas[3]	808	gallons	EDMS v5.1.3
Engine Startup	Jet A	228,822	gallons	EDMS v5.1.3
Aircraft Ground up to 3,000 feet	Jet A[2]	17,527,225	gallons	EDMS v5.1.3
	AvGas[3]	724	gallons	EDMS v5.1.3
Aircraft Support Equipment				
GSE	Diesel	650,257	gallons	Massport
	Gasoline	284,550	gallons	Massport
	Propane	1,682	gallons	EDMS v5.1.3
	CNG	413,281	ft^3	EDMS v5.1.3
APU	Jet A	792,147	gallons	EDMS v5.1.3
Motor Vehicles				
On-airport Vehicles	Composite[5]	61,190,976	VMT	Massport
On-airport Parking/Curbsides	Composite[5]	1,214,831	Idle hours	Massport
Massport Shuttle Bus	CNG	358,714	GEG	Massport
	Diesel	2,864	gallons	Massport
Massport Express Bus	Diesel	202,817	gallons	Massport
Masspoort Fire Rescue	Diesel	12,000	gallons	Massport
Aquircultural Equipment	Diesel	110,128	gallons	Massport
Massport Fleet Vehicles (Honda Civic)	CNG	78,579	GEG	Massport
Massport Fleet Vehicles (Fueled Onsite)	Gasoline	109,300	gallons	Massport
Massport Fleet Vehicles (Fueled Offsite)	Gasoline	82,197	gallons	Massport
Massport Fleet Vehicles (Fueled Onsite)	Diesel	248,691	gallons	Massport
Off-airport Vehicles (Public)	Composite[5]	149,813,495	VMT	Massport
Off-airport Vehicles (Airport Employees)	Composite[5]	3,581,673	VMT	Massport
Off-airport Vehicles (Tenant Employees)	Composite[5]	48,376,557	VMT	Massport
Stationary and Portable Sources				
Boilers and Space Heaters	No 2 Oil	384,906	gallons	Massport
	No 6 Oil	11,285	gallons	Massport
	Natural Gas	472.350	million ft^3	Massport
Generators	Diesel	75,863	gallons	Massport
Snow melters	ULSD	218,081	gallons	Massport
	CNG	7.48	million ft^3	Massport
Fire Training Facility	Tekflame	3,500	gallons	Massport
	AvGas	310	gallons	Massport
Electrical Consumption – Massport	-	25,428,190	kWh	Massport
Electrical Consumption – Common Area	-	101,291,489	kWh	Massport
Electrical Consumption – Tenant	-	56,542,521	kWh	Massport

Sources: Massport and KBE.

Notes: APU – Auxiliary power units; CNG – compressed natural gas; GEG – gasoline equivalent gallons; GSE – ground support equipment; kWh – kilowatt hours; VMT – vehicle miles traveled; ULSD – ultra low sulfur diesel

1 Based on 2011 activity levels and conditions.
2 Jet A density of 6.84 pounds per gallon.
3 AvGas density of 6.0 pounds per gallon.
4 The LTO (landing and take-off operation) includes landing, taxi-in, taxi-out, take-off, and up to an altitude of 3,000 feet.
5 Composite means gasoline and diesel-fueled motor vehicle feel mix based on MOBILE62.

Emission factors were obtained from the U.S. Energy Information Administration, the International Panel on Climate Change (IPCC), and the EPA.[7,8,9] Table I-17 presents these emission factors for CO_2, nitrous oxide (N_2O), and methane (CH_4).

Table I-17 Greenhouse Gas (GHG) Emission Factors

Sources	Fuel	CO_2	N_2O	CH_4	Units
Aircraft[1]	Jet A	21.095	0.000188	0.00052	lb/gallon
	AvGas	18.355	0.000188	0.00052	lb/gallon
Ground Support Equipment/ Auxiliary Power Units[1]	Diesel	22.384	0.0002	0.00053	lb/gallon
	Gasoline	19.564	0.0002	0.00055	lb/gallon
	CNG	120.593	0.0002	0.00020	lb/1000 ft^3
	Propane	12.669	2.30E-07	0.000003	lb/gallon
	Jet A	21.095	0.000188	0.00052	lb/gallon
Motor Vehicles[2]	Composite	368	0.005	0.017	g/mile
	Composite	921	0.0125	0.190	g/hour
	CNG	120.593	0.0002	0.00020	lb/1000 ft^3
	Diesel	22.384	0.0002	0.000534	lb/gallon
	Gasoline	19.564	0.0002	0.00055	lb/gallon
Stationary and Portable[1]	No. 2 Oil	22.384	0.000193	0.000534	lb/gallon
	No. 6 Oil	26.033	0.000208	0.000225	lb/gallon
	Natural Gas	120.593	0.0002	0.0002	lb/1000 ft^3
	ULSD	22.384	0.000193	0.000534	lb/gallon
Fire Training Facility[1]	Tekflame[3]	12.669	2.30E-07	0.000003	lb/gallon
	AvGas	18.355	0.000188	0.00052	lb/gallon
Electrical Consumption[4]	-	0.98	0.0000136	0.0000584	lb/kW-hr

Sources: Massport and KBE.
Notes: CH_4 – methane; CNG – compressed natural gas; CO_2 – carbon dioxide; g- grams; kWhr – kilowatt hour; lb – pound; N_20 – nitrous oxides.
1 Energy Information Administration, www.eia.doe.gov/oiaf/1605/coefficients.html.
2 Environmental Protection Agency, MOBILE6.2 Emissions Model and Volume 2 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
3 As propane
4 Energy Information Administration, *Updated State-and Regional-level Greenhouse Gas Emission Factors for Electricity* (March 2002), http://www.eia.gov/pub/oiaf/1605/cdrom/pdf/e-supdoc.pdf

7 U.S. Energy Information Administration, *Voluntary Reporting of Greenhouse Gases Program Fuel and Energy Source Codes and Emission Coefficients,* www.eia.doe.gov/oiaf/1605/coefficients.html
8 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, 2006, www.ipcc-nggip.iges.or.jp/public/2006gl/index.html
9 U.S. Environmental Protection Agency, MOBILE6.2 Emissions Model, www.epa.gov/otaq/m6.htm

Results

Table I-18 presents the results of the 2011 GHG emissions inventory for Logan Airport by emission source (i.e., aircraft, GSE, motor vehicles, and stationary sources) and compound (i.e., CO_2, N_2O, and CH_4).

Table I-18 Greenhouse Gas (GHG) Emissions (MMT CO_2 Eq)[1] for 2011

Activity	CO_2	N_2O	CH_4	Total
Aircraft Sources				
Aircraft Taxi	0.19	<0.01	<0.01	0.19
Engine Startup	<0.01	<0.01	<0.01	<0.01
Aircraft AGL to 3,000 feet	0.17	<0.01	<0.01	0.17
Aircraft Support Equipment				
GSE	0.01	<0.01	<0.01	0.01
APU	0.01	<0.01	<0.01	0.01
Motor Vehicles				
On-airport Vehicles	0.02	<0.01	<0.01	0.02
On-airport Parking/Curbsides	<0.01	<0.01	<0.01	<0.01
Massport Shuttle Buses	0.01	<0.01	<0.01	0.01
Massport Fleet Vehicles	0.01	<0.01	<0.01	0.01
Off-airport Vehicles (Public)	0.04	<0.01	<0.01	0.04
Off-airport Vehicles (Airport Employees)	<0.01	<0.01	<0.01	<0.01
Off-airport Vehicles (Tenant Employees)	0.02	<0.01	<0.01	0.02
Stationary Sources				
Boilers	0.03	<0.01	<0.01	0.03
Generators, Snow melters, etc.	<0.01	<0.01	<0.01	<0.01
Fire Training Facility	<0.01	<0.01	<0.01	<0.01
Electrical Consumption	0.08	<0.01	<0.01	0.08

Sources: Massport and KBE.
1 Units expressed as million metric tons of CO_2 equivalent (MMT CO_2 Eq): 1 metric ton = 1.1 short tons.

Table I-19 compares the total GHG emission from Logan Airport to the totals GHG emissions for Massachusetts.

Table I-19 Logan Airport Greenhouse Gas (GHG) Emissions Compared to Massachusetts Totals[1]

	CO_2	N_2O	CH_4	Totals
Logan Airport Emissions[2]	0.58	<0.01	<0.01	0.58
Massachusetts[3]	82.1	1.3	1.2	84.6
Percent of Logan Airport to Massachusetts[4]	<1%	<1%	<1%	<1%

Sources: Massport and KBE.
1 Units expressed as million metric tons of CO_2 equivalents (MMT CO_2 Eq): 1 metric ton = 1.1 short tons.
2 Total from Massport, tenants, and public categories.
3 Climate Analysis Indicators Tool (CAIT US) Version 4.0. (Washington, DC: World Resources Institute, 2010)
4 Percentages represent the relative amount Logan-related emissions compared to the state totals.

Table I-20 provides a comparison between Airport-related GHG emissions from 2007 through 2011. GHG emissions in 2011 were slightly higher (4.8 percent) than 2010 levels. In order to equally compare to previous years, the 2011 emissions are summarized in a manner similar to previous years.

Table I-20 Comparison of Estimated Total Greenhouse Gas (GHG) Emissions (MMT of CO_2eq) at Logan Airport – 2007 through 2011

Source	2007	2008	2009	2010	2011
Direct Emissions[2]					
Aircraft[3]	0.22	0.21	0.19	0.18	0.19
GSE/APUs	0.08	0.08	0.02	0.02	0.02
Motor vehicles[4]	0.03	0.03	0.03	0.03	0.04
Other sources[5]	0.04	0.03	0.03	0.03	0.03
Total Direct Emissions	0.37	0.35	0.27	0.27	0.28
Indirect Emissions[6]					
Aircraft[7]	0.18	0.17	0.17	0.17	0.17
Motor vehicles[8]	0.05	0.05	0.05	0.05	0.06
Electrical consumption[9]	0.09	0.08	0.07	0.07	0.08
Total Indirect Emissions	0.32	0.30	0.29	0.29	0.30
Total Emissions[10]	0.69	0.65	0.56	0.56	0.58
Percent of State Totals[11]	<1	<1	<1	<1	<1

Sources: Massport and KBE.
1 MMT - million metric tons of CO_2 equivalents (1 MMT = 1.1M Short Tons). CO_2 equivalents (CO_2eq) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O and CH_4) in common units. Quantities are reported as "rounded" and truncated values for ease of addition.
2 Direct emissions are those that occur in areas located within the Airport's geographic boundaries.
3 Direct aircraft emissions based engine start-up, taxi-in, taxi-out and ground-based delay emissions.
4 Direct motor vehicle emissions based on on-site vehicle miles traveled (VMT).
5 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters and live fire training facility.
6 Indirect emissions are those that occur off the Airport site.
7 Indirect aircraft emissions are based on take-off, climb-out and landing emissions which occur up to an altitude of 3,000 ft., the limits of the landing/take-off (LTO) cycle
8 Indirect motor vehicle emissions based on off-site Airport-related VMT and an average round trip distance of 60.5 miles (2010 Passenger Ground Access Survey).
9 Electrical consumption emissions occur off-airport at power generating plants.
10 Total Emissions = Direct +Indirect.
11 Percentage based on relative amount of Airport total of direct emissions to statewide total from World Resources Institute (cait.wri.org).

Greenhouse Gas Emissions Inventory for 2030

Methodology

Airport GHG emissions for 2030 are calculated in the same manner as for 2011, through the use of input data such as activity levels or material throughput rates (i.e., fuel usage, VMT, electrical consumption) that are applied to appropriate emission factors (i.e., in units of GHG emissions per gallon of fuel). Activity levels and material throughput rates were estimated based on scaling the 2011 data (or recent five-year average) to 2030 as a function of the forecasted changes in aircraft operations, traffic volumes, passenger counts, terminal square footage, or similar matrices over this timeframe. Generally, these estimates represent a conservative calculation of the activity and material rates during 2030 and thus, a conservative estimate of the GHG emissions. Table I-21 summarizes these data and information used in the 2030 GHG emissions inventory.

Table I-21 Logan Airport Greenhouse Gas (GHG) Inventory Input Data and Information[1] for 2030

Activity	Fuel Type	Usage	Units	Source
Aircraft				
Aircraft Taxi	Jet A[2]	21,198,863	gallons	EDMS v5.1.3
	AvGas[3]	876	gallons	EDMS v5.1.3
Engine Startup	Jet A	302,531	gallons	EDMS v5.1.3
Aircraft Ground up to 3,000 feet	Jet A[2]	23,537,689	gallons	EDMS v5.1.3
	AvGas[3]	972	gallons	EDMS v5.1.3
Aircraft Support Equipment				
GSE	Diesel	836,612	gallons	Massport
	Gasoline	366,098	gallons	Massport
	Propane	2,407	gallons	EDMS v5.1.3
	CNG	575,465	ft^3	EDMS v5.1.3
APU	Jet A	1,075,075	gallons	EDMS v5.1.3
Motor Vehicles				
On-airport Vehicles	Composite[5]	71,334,417	VMT	Massport
On-airport Parking/Curbsides	Composite[5]	1,685,021	Idle hours	Massport
Massport Shuttle Bus	CNG	494,262	GEG	Massport
	Diesel	3,946	gallons	Massport
Massport Express Bus	Diesel	279,456	gallons	Massport
Masspoort Fire Rescue	Diesel	15,439	gallons	Massport
Aquircultural Equipment	Diesel	141,689	gallons	Massport
Massport Fleet Vehicles (Honda Civic)	CNG	101,099	GEG	Massport
Massport Fleet Vehicles (Fueled Onsite)	Gasoline	140,624	gallons	Massport
Massport Fleet Vehicles (Fueled Offsite)	Gasoline	105,754	gallons	Massport
Massport Fleet Vehicles (Fueled Onsite)	Diesel	319,963	gallons	Massport
Off-airport Vehicles (Public)	Composite[5]	157,050,804	VMT	Massport
Off-airport Vehicles (Airport Employees)	Composite[5]	3,814,077	VMT	Massport
Off-airport Vehicles (Tenant Employees)	Composite[5]	51,515,572	VMT	Massport
Stationary and Portable Sources				
Boilers and Space Heaters	No 2 Oil	363,959	gallons	Massport
	No 6 Oil	252,061	gallons	Massport
	Natural Gas	443,646	million ft^3	Massport
Generators	Diesel	38,192	gallons	Massport
Snow melters	ULSD	158,838	gallons	Massport
	Natural Gas	3.01	million ft^3	Massport
Fire Training Facility	Tekflame	4,482	gallons	Massport
	AvGas	379	gallons	Massport
Electrical Consumption – Massport	-	26,226,705	kWh	Massport
Electrical Consumption – Common Area	-	104,472,319	kWh	Massport
Electrical Consumption – Tenant	-	58,318,110	kWh	Massport

Sources: Massport and KBE.

Notes: APU – Auxiliary power units; CNG – compressed natural gas; GEG – gasoline equivalent gallons; GSE – ground support equipment; kWh – kilowatt hours; VMT – vehicle miles traveled; ULSD – ultra low sulfur diesel

1 Based on 2011 activity levels and conditions.
2 Jet A density of 6.84 pounds per gallon.
3 AvGas density of 6.0 pounds per gallon.
4 The LTO (landing and take-off operation) includes landing, taxi-in, taxi-out, take-off, and up to an altitude of 3,000 feet.
5 Composite means gasoline and diesel-fueled motor vehicle feel mix based on MOBILE62.

Results

Table I-22 presents the results of the 2030 GHG emissions inventory for Logan Airport by emission source (i.e., aircraft, GSE, motor vehicles, and stationary sources) and compound (i.e., CO_2, N_2O, and CH_4).

Table I-22 Greenhouse Gas (GHG) Emissions (MMT CO_2 Eq)[1] for 2030

Activity	CO_2	N_2O	CH_4	Total
Aircraft Sources				
Aircraft Taxi	0.20	<0.01	<0.01	0.20
Engine Startup	<0.01	<0.01	<0.01	<0.01
Aircraft AGL to 3,000 feet	0.23	<0.01	<0.01	0.23
Aircraft Support Equipment				
GSE	0.01	<0.01	<0.01	0.01
APU	0.01	<0.01	<0.01	0.01
Motor Vehicles				
On-airport Vehicles	0.02	<0.01	<0.01	0.02
On-airport Parking/Curbsides	<0.01	<0.01	<0.01	<0.01
Massport Shuttle Buses	0.01	<0.01	<0.01	0.01
Massport Fleet Vehicles	0.01	<0.01	<0.01	0.01
Off-airport Vehicles (Public)	0.03	<0.01	<0.01	0.03
Off-airport Vehicles (Airport Employees)	<0.01	<0.01	<0.01	<0.01
Off-airport Vehicles (Tenant Employees)	0.01	<0.01	<0.01	0.01
Stationary Sources				
Boilers	0.03	<0.01	<0.01	0.04
Generators, Snow melters, etc.	<0.01	<0.01	<0.01	<0.01
Fire Training Facility	<0.01	<0.01	<0.01	<0.01
Electrical Consumption	0.08	<0.01	<0.01	0.08

Sources: Massport and KBE.
1 Units expressed as million metric tons of CO2 equivalent (MMT CO2 Eq): 1 metric ton = 1.1 short tons.

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J

Water Quality/ Environmental Compliance and Management

This appendix provides detailed information in support of *Chapter 8, Water Quality/Environmental Compliance and Management:*

- Table J-1 National Pollutant Discharge Elimination System (NPDES) Permit Stormwater Outfall Monitoring Requirements (2007)
- Table J-2 Logan Airport 2011 Monthly Monitoring Results for First Quarter — North, West, and Maverick Street Stormwater Outfalls
- Table J-3 Logan Airport 2011 Monthly Monitoring Results for First Quarter — Porter Street Stormwater Outfall
- Table J-4 Logan Airport 2011 Monthly Monitoring Results for Second Quarter — North, West, and Maverick Street Stormwater Outfalls
- Table J-5 Logan Airport 2011 Monthly Monitoring Results for Second Quarter — Porter Street Stormwater Outfall
- Table J-6 Logan Airport 2011 Monthly Monitoring Results for Third Quarter — North, West, and Maverick Street Stormwater Outfalls
- Table J-7 Logan Airport 2011 Monthly Monitoring Results for Third Quarter — Porter Street Stormwater Outfall
- Table J-8 Logan Airport 2011 Monthly Monitoring Results for Fourth Quarter — North, West, and Maverick Street Stormwater Outfalls
- Table J-9 Logan Airport 2011 Monthly Monitoring Results for Fourth Quarter — Porter Street Stormwater Outfall
- Table J-10 Logan Airport 2011 Quarterly Wet Weather Monitoring Results — North, West, Maverick Street, and Porter Street Stormwater Outfalls

- Table J-11 Logan Airport 2011 Quarterly Wet Weather Monitoring Results – Northwest and Runway/Perimeter Stormwater Outfalls
- Table J-12 Logan Airport 2011 Wet Weather Deicing Monitoring Results – North, West, and Porter Street Stormwater Outfalls
- Table J-13 Logan Airport 2011 Wet Weather Deicing Monitoring Results – Runway/Perimeter Stormwater Outfalls
- Table J-14 Logan Airport Stormwater Outfall NPDES Water Quality Monitoring Results – 1993 to 2011
- Table J-15 Logan Airport Oil and Hazardous Material Spills and Jet Fuel Handling – 1990 to 2011
- Table J-16 Type and Quantity of Oil and Hazardous Material Spills at Logan Airport – 1999 to 2011
- Letter to Environmental Protection Agency Regarding Discharge Monitoring Reports for Logan Airport Outfalls for January 2011, dated February 15, 2011.
- Letter to Environmental Protection Agency Regarding Discharge Monitoring Reports for Logan Airport Outfalls for March 2011, dated April 15, 2011.
- Letter to Environmental Protection Agency Regarding Discharge Monitoring Reports for Logan Airport Outfalls for April 2011, dated May 16, 2011.
- Letter to Environmental Protection Agency Regarding Discharge Monitoring Reports for Logan Airport Outfalls for July 2011, dated August 15, 2011.
- Letter to Environmental Protection Agency Regarding Discharge Monitoring Reports for Logan Airport Outfalls for November 2011, dated December 15, 2011.
- EnviroNews Vol. 36, Issue 4 – December 2010/January 2011
  Vol. 37, Issue 1 – May 2011
  Vol. 37, Issue 3 – December 2011/January 2012

Table J-1 NPDES Permit Stormwater Outfall Monitoring Requirements (2007)

	North Outfall 001		West Outfall 002		Maverick Outfall 003	
Monitoring Event	**Field Measurement**	**Laboratory Analysis**	**Field Measurement**	**Laboratory Analysis**	**Field Measurement**	**Laboratory Analysis**
Monthly Dry Weather	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*
Monthly Wet Weather	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*
Quarterly Wet Weather	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene
Deicing Episode (2/Deicing Season)	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolytriazole	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolytriazole	Not Required	Not Required
Whole Effluent Toxicity (1st and 3rd Year Deicing Season)	Not Required	Menidia beryllina Arbacia punctulata	Not Required	Menidia beryllina Arbacia punctulata	Not Required	Not Required
Treatment System Sampling (Internal Outfalls)[7]	pH Quantity, Gallons	Oil and Grease TSS[1] Benzene[2]	Not Required	Not Required	Not Required	Not Required

Table J-1 NPDES Permit Stormwater Outfall Monitoring Requirements (2007) (continued)

	Northwest Outfall 005		Porter Outfall 003 (3 upstream locations)		Select Runway/Perimeter Outfalls	
Monitoring Event	**Field Measurement**	**Laboratory Analysis**	**Field Measurement**	**Laboratory Analysis**	**Field Measurement**	**Laboratory Analysis**
Monthly Dry Weather	Not Required	Not Required	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*	Not Required	Not Required
Monthly Wet Weather	Not Required	Not Required	pH Flow Rate	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*	Not Required	Not Required
Quarterly Wet Weather	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2]	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene	pH	Oil and Grease TSS[1] Benzene[2]
Deicing Episode (2/Deicing Season)	Not Required	Not Required	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolytriazole	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolytriazole
Whole Effluent Toxicity (1st and 3rd Year Deicing Season)	Not Required	Not Required	Not Required	Menidia beryllina Arbacia punctulata	Not Required	Not Required
Treatment System Sampling (Internal Outfalls)[7]	Not Required	Not Required	Not Required	Not Required	Not Required	Not Required

Source: Massport

Notes: Requirements are from NPDES Permit MA0000787, issued July 31, 2007.

1 TSS - Total Suspended Solids

2 Benzene must be collected with HDPE bailer.

3 PAH - Polycyclic Aromatic Hydrocarbons

4 BOD - Biological Oxygen Demand

5 COD - Chemical Oxygen Demand

6 Flow Rate will be estimated based on measured precipitation and the hydraulic model developed for the Logan Airport drainage system.

7 Outfalls 001D and 001E samples collected by Swissport.

Table J-2 Logan Airport 2011 Monthly Monitoring Results for First Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
001A – North Outfall[1]	1/18/2011	Wet Weather	2.24	0.54	6.42	<4.4	22	<1.0	0.15	170	<10
002A – West Outfall[1]	1/18/2011	Wet Weather	9.87	1.52	6.36	**28**	**230**	4.5	0.24	440	220
004A – Maverick Street Outfall[23]	1/25/2011	Wet Weather	0.83	0.09	6.35	<4.0	38	NA	0.42	30	70
001C – North Outfall	1/24/2011	Dry Weather				<4.0	25	<1.0	0.14	90	30
002C – West Outfall	1/24/2011	Dry Weather				<4.4	26	<1.0	0.06	500	240
004C – Maverick Street Outfall	1/24/2011	Dry Weather				<4.4	26	<1.0	0.05	10	10
001A – North Outfall	2/25/2011	Wet Weather	3.95	0.50	7.23	5.3	40	<1.0	0.07	50	1,300
002A – West Outfall	2/25/2011	Wet Weather	14.05	1.73	6.89	4.5	56	<1.0	0.07	750	350
004A – Maverick Street Outfall	2/25/2011	Wet Weather	0.97	0.11	7.04	4.2	31	<1.0	0.06	40	150
001C – North Outfall	2/11/2011	Dry Weather				<4.0	27	<1.0	0.06	490	50
002C – West Outfall	2/11/2011	Dry Weather				<4.0	19	<1.0	0.06	3,000	390
004C – Maverick Street Outfall[4]	2/18/2011	Dry Weather				<4.4	30	<1.0	0.17	490	700
001A – North Outfall	3/11/2011	Wet Weather	1.25	0.26	7.47	<4.0	26	<1.0	0.09	160	530
002A – West Outfall	3/11/2011	Wet Weather	4.50	1.10	6.74	8.4	66	<1.0	0.11	3,600	380
004A – Maverick Street Outfall	3/11/2011	Wet Weather	0.37	0.06	7.77	12	**110**	<1.0	0.15	2,000	3,300
001C – North Outfall	3/15/2011	Dry Weather				<4.0	22	<1.0	0.07	90	10
002C – West Outfall	3/15/2011	Dry Weather				<4.0	18	<1.0	0.06	720	280
004C – Maverick Street Outfall	3/15/2011	Dry Weather				<4.4	14	<1.0	<0.05	<10	<10
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report
Average Daily			Report	Report	6.0 to 8.5	–	Report	Report	Report	Report	Report

Source: Massport

Notes: Flow rates were estimated for outfalls 001, 002, and 004 by using the SWMM model developed for Logan Airport.

Bold values exceed maximum daily discharge limitation.

For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 Due to hazardous driving conditions preventing transport to the laboratory, the fecal coliform and Enterococcus samples for all external outfalls were collected on January 25, 2011.

2 The Maverick Street Outfall was inaccessible on January 18, 2011 and therefore was sampled on January 25, 2011.

3 Benzene was not analyzed (denoted with NA) at the Maverick Street Outfall since sampling vials were misplaced by the laboratory while in their custody.

4 The Maverick Street Outfall was dry on February 11, 2011 and therefore a sample was collected on February 18, 2011.

TSS Total Suspended Solids

NS Not Sampled

Table J-3 Logan Airport 2011 Stormwater Outfalls Monthly Monitoring Results for First Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1[1]	1/18/2011	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	1/18/2011	Wet Weather	-	-	8.36	10	30	<1.0	0.11	<10	<10
003 - Porter Street Outfall 3[1]	1/18/2011	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall Average		Wet Weather	1.79	0.27	8.36	0.0	30	0.0	0.11	1.0	1.0
003 - Porter Street Outfall 1[1]	1/24/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	1/24/2011	Dry Weather				<4.4	15	<1.0	0.09	<10	10
003 - Porter Street Outfall 3[1]	1/24/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall Average		Dry Weather				0.0	15	0.0	0.09	1.0	10
003 - Porter Street Outfall 1[2]	2/25/2011	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	2/25/2011	Wet Weather	-	-	7.04	<4.4	18	<1.0	<0.05	<10	<10
003 - Porter Street Outfall 3[3]	2/25/2011	Wet Weather	-	-	7.13	<4.0	17	<1.0	<0.05	<10	60
003 - Porter Street Outfall Average		Wet Weather	2.59	0.28	7.09	0.0	17.5	0.0	0.0	1.0	7.7
003 - Porter Street Outfall 1[2]	2/11/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	2/11/2011	Dry Weather				<4.0	10	<1.0	0.08	10	<10
003 - Porter Street Outfall 3[3]	2/18/2011	Dry Weather				5.0	22	<1.0	0.19	<10	80
003 - Porter Street Outfall Average		Dry Weather				2.5	16	0.0	0.14	3.2	8.9
003 - Porter Street Outfall 1[2]	3/11/2011	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	3/11/2011	Wet Weather	-	-	7.37	<4.0	20	<1.0	<0.05	<10	<10
003 - Porter Street Outfall 3[3]	3/11/2011	Wet Weather	-	-	6.71	<4.0	19	<1.0	0.08	60	30
003 - Porter Street Outfall Average		Wet Weather	0.94	0.15	7.04	0.0	19.5	0.0	0.04	7.7	5.5
003 - Porter Street Outfall 1[2]	3/15/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	3/15/2011	Dry Weather				<4.0	<5.0	<1.0	0.06	<10	<10
003 - Porter Street Outfall 3[3]	3/15/2011	Dry Weather				<4.4	<5.0	<1.0	0.09	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	0.0	0.0	0.08	1.0	1.0
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Daily			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report

Source: Massport

Notes: **Bold** values exceed maximum daily discharge limitation.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 The Porter Street Outfall 1 and Porter Street Outfall 3 were not accessible due to construction; therefore samples were not collected from either location.
2 The Porter Street Outfall 1 was not accessible due to construction; therefore samples were not collected from either location.
3 A new sampling location was established for Porter Street Outfall 3 due to ongoing construction. It was sampled for the first time on February 18, 2011.
TSS Total Suspended Solids

Table J-4 Logan Airport 2011 Stormwater Outfalls Monthly Monitoring Results for Second Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
001A – North Outfall	4/13/2011	Wet Weather	4.90	0.59	7.33	<4.4	5.5	<1.0	0.06	470	2,800
002A – West Outfall	4/13/2011	Wet Weather	15.52	2.36	7.41	**24**	**560**	<1.0	0.07	570	630
004A – Maverick Street Outfall	4/13/2011	Wet Weather	1.20	0.14	7.20	<4.0	8.6	<1.0	0.27	810	670
001C – North Outfall	4/8/2011	Dry Weather				<4.4	22	<1.0	0.12	70	20
002C – West Outfall	4/8/2011	Dry Weather				<4.0	15	<1.0	0.11	670	190
004C – Maverick Street Outfall	4/8/2011	Dry Weather				<4.4	10	<1.0	0.87	220	130
001A – North Outfall	5/23/2011	Wet Weather	1.62	0.25	7.76	<4.0	9.3	<1.0	0.22	600	390
002A – West Outfall	5/23/2011	Wet Weather	5.56	1.03	7.42	<4.0	15	<1.0	0.10	1,600	680
004A – Maverick Street Outfall	5/23/2011	Wet Weather	0.44	0.06	7.54	<4.0	17	<1.0	<0.05	210	470
001C – North Outfall	5/12/2011	Dry Weather				<4.0	20	<1.0	0.57	430	360
002C – West Outfall	5/12/2011	Dry Weather				<4.0	12	<1.0	0.14	4,800	410
004C – Maverick Street Outfall	5/12/2011	Dry Weather				<4.0	7.0	<1.0	0.05	20	20
001A – North Outfall	6/29/2011	Wet Weather	5.40	0.52	8.20	<4.0	11	<1.0	0.35	720	540
002A – West Outfall	6/29/2011	Wet Weather	14.08	1.96	7.11	<4.4	20	<1.0	0.17	6,000	13,000
004A – Maverick Street Outfall	6/29/2011	Wet Weather	1.43	0.13	6.75	<4.0	11	<1.0	<0.05	200	100
001C – North Outfall	6/8/2011	Dry Weather				<4.0	13	<1.0	0.11	320	260
002C – West Outfall	6/8/2011	Dry Weather				<4.0	16	<1.0	0.06	4,900	1,300
004C – Maverick Street Outfall	6/8/2011	Dry Weather				<4.0	11	<1.0	<0.05	20	40
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report
Average Daily			Report	Report	6.0 to 8.5	–	Report	Report	Report	Report	Report

Source: Massport

Notes: Flow rates were estimated for outfalls 001, 002, and 004 by using the SWMM model developed for Logan Airport.
Bold values exceed maximum daily discharge limitation.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

TSS Total Suspended Solids
NA Not Analyzed
NS Not Sampled

Table J-5 Logan Airport 2011 Stormwater Outfalls Monthly Monitoring Results for Second Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1[1]	4/13/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	4/13/2011	Wet Weather	---	---	7.30	<4.4	<5.0	<1.0	<0.05	<10	30
003 - Porter Street Outfall 3[2]	4/13/2011	Wet Weather	---	---	7.28	<4.0	<5.0	<1.0	0.07	<10	40
003 - Porter Street Outfall Average		Wet Weather	2.82	0.37	7.29	0.0	0.0	0.0	0.04	1.0	34.6
003 - Porter Street Outfall 1[1]	4/8/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	4/8/2011	Dry Weather				<4.0	<5.0	<1.0	0.06	<10	<10
003 - Porter Street Outfall 3[2]	4/8/2011	Dry Weather				<4.4	24	<1.0	0.15	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	12	0.0	0.11	1.0	1.0
003 - Porter Street Outfall 1[1]	5/23/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	5/23/2011	Wet Weather	---	---	8.01	<4.0	<5.0	<1.0	<0.05	80	1,000
003 - Porter Street Outfall 3[2]	5/23/2011	Wet Weather	---	---	7.82	<4.0	<5.0	<1.0	<0.05	20	530
003 - Porter Street Outfall Average		Wet Weather	1.22	0.15	7.92	0.0	0.0	0.0	0.0	40	728
003 - Porter Street Outfall 1[1]	5/12/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	5/12/2011	Dry Weather				<4.0	<5.0	<1.0	0.13	55	40
003 - Porter Street Outfall 3[2]	5/12/2011	Dry Weather				<4.4	43	<1.0	0.09	10	30
003 - Porter Street Outfall Average		Dry Weather				0.0	22	0.0	0.11	23.5	34.6
003 - Porter Street Outfall 1[1]	6/29/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	6/29/2011	Wet Weather	---	---	8.06	13	<5.0	<1.0	0.13	20	6,600
003 - Porter Street Outfall 3[2]	6/29/2011	Wet Weather	---	---	7.98	13	<5.0	<1.0	0.34	130	1,400
003 - Porter Street Outfall Average		Wet Weather	3.12	0.35	8.02	6.5	0.0	0.0	0.24	51	3,040
003 - Porter Street Outfall 1[1]	6/8/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	6/8/2011	Dry Weather				<4.0	40	<1.0	0.14	<10	<10
003 - Porter Street Outfall 3[2]	6/8/2011	Dry Weather				<4.0	<5.0	<1.0	0.19	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	20	0.0	0.17	1.0	1.0
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Daily			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report

Source: Massport

Notes: Porter Street Outfall location 3 (PSO-MH75) exhibited low flow during the wet sampling event and was dry during the dry sampling event, therefore PSO-MH78 was sampled in its place for both samples.
Bold values exceed maximum daily discharge limitation.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 The Porter Street Outfall 1 was not accessible due to construction; therefore samples were not collected from this location.

2 A new sampling location was established for Porter Street Outfall 3 due to ongoing construction. It was sampled for the first time on February 18, 2011.

TSS Total Suspended Solids

NS Not Sampled

Table J-6 Logan Airport 2011 Stormwater Outfalls Monthly Monitoring Results for Third Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella*[1] (cfu/100mL)
001A – North Outfall	7/8/2011	Wet Weather	2.56	0.19	8.41	<4.0	6.4	<1.0	0.52	31,000	1,000	2,400
002A – West Outfall	7/8/2011	Wet Weather	11.09	0.71	7.86	<4.0	16	<1.0	0.40	11,000	6,600	
004A – Maverick Street Outfall	7/8/2011	Wet Weather	0.59	0.03	7.55	<4.0	17	<1.0	0.28	5,900	3,600	
001C – North Outfall	7/25/2011	Dry Weather				<4.0	9.0	<1.0	0.40	63,000	1,300	>8,000
002C – West Outfall	7/25/2011	Dry Weather				<4.0	15	<1.0	029	52,00	6,500	
004C – Maverick Street Outfall	7/25/2011	Dry Weather				<4.0	**370**	<1.0	012	<10	700	
001A – North Outfall	8/15/2011	Wet Weather	4.25	0.75	7.79	<4.0	<5.0	<1.0	0.18	2,400	3,600	<10
002A – West Outfall	8/15/2011	Wet Weather	18.11	2.72	6.82	<4.0	17	<1.0	0.22	16,000	5,600	
004A – Maverick Street Outfall[2]	8/15/2011	Wet Weather	1.10	0.18	NS	NS	NS	NS	NS	NS	NS	
001C – North Outfall	8/25/2011	Dry Weather				4.1	20	<1.0	0.08	35,000	520	<10
002C – West Outfall	8/25/2011	Dry Weather				<4.0	8.2	<1.0	0.07	30,000	10,000	
004C – Maverick Street Outfall	8/25/2011	Dry Weather				<4.0	42	<1.0	0.05	400	180	
001A – North Outfall	9/6/2011	Wet Weather	4.04	0.42	7.48	<4.0	<5.0	<1.0	0.12	3,300	1,100	NA
002A – West Outfall	9/6/2011	Wet Weather	15.42	1.54	7.89	<4.0	8.0	<1.0	0.13	5,400	3,500	
004A – Maverick Street Outfall	9/6/2011	Wet Weather	0.92	0.10	7.17	<4.0	92	<1.0	0.10	2,100	1,500	
001C – North Outfall	9/15/2011	Dry Weather				<4.0	19	<1.0	0.19	16,000	610	11,000
002C – West Outfall	9/15/2011	Dry Weather				<4.0	15	<1.0	0.24	5,500	3,600	
004C – Maverick Street Outfall	9/15/2011	Dry Weather				<4.0	16	<1.0	0.05	120	410	
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report	Report
Average Daily			Report	Report	6.0 to 8.5	----	Report	Report	Report	Report	Report	Report

Source: Massport

Notes: Flow rates were estimated for outfalls 001, 002, and 004 by using the SWMM model developed for Logan Airport.
Bold values exceed maximum daily discharge limitation.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.

2 The Maverick Street Outfall was not accessible due to construction; therefore, a sample was not collected

TSS Total Suspended Solids

NA Not Analyzed

NS Not Sampled

Table J-7 Logan Airport 2011 Stormwater Outfalls Monthly Monitoring Results for Third Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1[1]	7/8/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	7/8/2011	Wet Weather	---	---	8.48	<4.4	<5.0	<1.0	0.14	90	5,200
003 - Porter Street Outfall 3[2]	7/8/2011	Wet Weather	---	---	8.50	<4.0	<5.0	<1.0	0.58	240	640
003 - Porter Street Outfall Average		Wet Weather	2.20	0.11	8.49	0.0	0.0	0.0	0.36	147	1,824
003 - Porter Street Outfall 1[1]	7/25/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	7/25/2011	Dry Weather				<4.0	10	<1.0	0.12	30	140
003 - Porter Street Outfall 3[2]	7/25/2011	Dry Weather				<4.0	81	<1.0	0.67	100	20
003 - Porter Street Outfall Average		Dry Weather				0.0	46	0.0	0.40	55	53
003 - Porter Street Outfall 1[1]	8/15/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	8/15/2011	Wet Weather	---	---	8.04	<4.0	<5.0	<1.0	0.07	18,000	130
003 - Porter Street Outfall 3[2]	8/15/2011	Wet Weather	---	---	7.81	<4.4	<5.0	<1.0	0.09	560	740
003 - Porter Street Outfall Average		Wet Weather	4.78	0.56	7.93	0.0	0.0	0.0	0.08	3,175	310
003 - Porter Street Outfall 1[1]	8/25/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	8/25/2011	Dry Weather				<4.0	<5.0	<1.0	0.05	<10	20
003 - Porter Street Outfall 3[2]	8/25/2011	Dry Weather				<4.0	<5.0	<1.0	0.26	50	155
003 - Porter Street Outfall Average		Dry Weather				0.0	0.0	0.0	0.16	7.1	56
003 - Porter Street Outfall 1[1]	9/6/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	9/6/2011	Wet Weather	---	---	8.21	<4.0	<5.0	<1.0	<0.05	<10	60
003 - Porter Street Outfall 3[2]	9/6/2011	Wet Weather	---	---	7.73	<4.0	<5.0	<1.0	0.16	360	360
003 - Porter Street Outfall Average		Wet Weather	3.13	0.31	7.97	0.0	0.0	0.0	0.08	19	147
003 - Porter Street Outfall 1[1]	9/15/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	9/15/2011	Dry Weather				<4.0	<5.0	<1.0	0.13	50	50
003 - Porter Street Outfall 3[2]	9/15/2011	Dry Weather				<4.0	5.6	<1.0	0.23	150	230
003 - Porter Street Outfall Average		Dry Weather				0.0	2.8	0.0	0.18	86.6	107
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Daily			Report	Report	6.0 to 8.5	–	Report	Report	Report	Report	Report

Source: Massport

Notes: **Bold** values exceed maximum daily discharge limitation.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 The Porter Street Outfall 1 was not accessible due to construction; therefore samples were not collected from this location.

2 A new sampling location was established for Porter Street Outfall 3 due to ongoing construction. It was sampled for the first time on February 18, 2011.

TSS Total Suspended Solids

NA Not Analyzed

NS Not Sampled

Table J-8 Logan Airport 2011 Stormwater Outfalls Monthly Monitoring Results for Fourth Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella*[1] (cfu/100mL)
001A – North Outfall	10/13/2011	Wet Weather	3.94	0.73	7.99	<4.0	6.1	<1.0	0.07	14,000	7,000	6,000
002A – West Outfall	10/13/2011	Wet Weather	13.48	2.65	6.92	<4.0	11	<1.0	0.19	3,300	1,200	
004A – Maverick Street Outfall	10/13/2011	Wet Weather	0.96	0.18	7.37	<4.0	34	<1.0	0.14	3,300	1,500	
001C – North Outfall	10/7/2011	Dry Weather				<4.0	11	<1.0	0.14	19,000	250	24,000
002C – West Outfall	10/7/2011	Dry Weather				<4.0	15	<1.0	0.10	4,400	4,500	
004C – Maverick Street Outfall	10/7/2011	Dry Weather				<4.0	18	<1.0	0.06	40	90	
001A – North Outfall	11/10/2011	Wet Weather	5.40	0.50	7.47	<4.0	40	<1.0	0.28	>80,000	660	19,000
002A – West Outfall	11/10/2011	Wet Weather	19.06	1.92	7.81	<4.0	24	<1.0	0.11	2,800	1,600	
004A – Maverick Street Outfall	11/10/2011	Wet Weather	1.24	0.12	6.78	<4.0	57	<1.0	0.13	13,000	4,300	
001C – North Outfall	11/3/2011	Dry Weather				<4.0	<5.0	<1.0	0.06	25,000	80	10,000
002C – West Outfall	11/3/2011	Dry Weather				<4.0	15	<1.0	0.05	2,700	910	
004C – Maverick Street Outfall	11/3/2011	Dry Weather				<4.0	**150**	<1.0	<0.05	4,600	200	
001A – North Outfall	12/15/2011	Wet Weather	5.16	0.564	7.44	<4.0	14	<1.0	0.08	8,000	90	<10
002A – West Outfall	12/15/2011	Wet Weather	19.6	2.24	7.46	<4.0	33	<1.0	0.09	6,300	1,400	
004A – Maverick Street Outfall	12/15/2011	Wet Weather	1.29	0.148	7.57	<4.0	<5.0	<1.0	<0.05	240	150	
001C – North Outfall	12/13/2011	Dry Weather				<4.0	11	<1.0	0.12	3,500	280	NA
002C – West Outfall	12/13/2011	Dry Weather				<4.0	10	<1.0	<0.05	50	320	
004C – Maverick Street Outfall	12/13/2011	Dry Weather				<4.0	17	<1.0	<0.05	440	260	
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report	Report
Average Daily			Report	Report	6.0 to 8.5	–	Report	Report	Report	Report	Report	Report

Source: Massport

Notes: Flow rates were estimated for outfalls 001, 002, and 004 by using the SWMM model developed for Logan Airport.

Bold values exceed maximum daily discharge limitation.

For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.

TSS Total Suspended Solids

NA Not Analyzed

Table J-9 Logan Airport 2011 Stormwater Outfalls Monthly Monitoring Results for Fourth Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1[1]	10/13/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	10/13/2011	Wet Weather	---	---	6.70	<4.0	22	<1.0	<0.05	<10	30
003 - Porter Street Outfall 3[2]	10/13/2011	Wet Weather	---	---	6.58	<4.0	8.9	<1.0	<0.05	100	1,500
003 - Porter Street Outfall Average		Wet Weather	2.31	0.51	6.64	0.0	15	0.0	0.0	10	212
003 - Porter Street Outfall 1[1]	10/7/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	10/7/2011	Dry Weather				<4.0	<5.0	<1.0	0.05	<10	60
003 - Porter Street Outfall 3[2]	10/7/2011	Dry Weather				<4.0	<5.0	<1.0	0.17	20	250
003 - Porter Street Outfall Average		Dry Weather				0.0	0.0	0.0	0.11	4.5	122
003 - Porter Street Outfall 1[1]	11/10/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	11/10/2011	Wet Weather	---	---	8.06	<4.0	<5.0	<1.0	0.13	<10	80
003 - Porter Street Outfall 3[2]	11/10/2011	Wet Weather	---	---	7.51	<4.0	<5.0	<1.0	0.10	480	220
003 - Porter Street Outfall Average		Wet Weather	3.43	0.34	7.79	0.0	0.0	0.0	0.12	22	133
003 - Porter Street Outfall 1[1]	11/3/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	11/3/2011	Dry Weather				<4.0	18	<1.0	<0.05	<10	80
003 - Porter Street Outfall 3[2]	11/3/2011	Dry Weather				<4.0	<5.0	<1.0	0.10	<10	10
003 - Porter Street Outfall Average		Dry Weather				0.0	9.0	0.0	0.05	1.0	28
003 - Porter Street Outfall 1	12/15/2011	Wet Weather	---	---	8.05	<4.0	40	<1.0	<0.05	<10	<10
003 - Porter Street Outfall 2	12/15/2011	Wet Weather	---	---	7.77	<4.0	<5.0	<1.0	<0.05	<10	10
003 - Porter Street Outfall 3[2]	12/15/2011	Wet Weather	---	---	7.86	<4.0	22	<1.0	0.11	10	260
003 - Porter Street Outfall Average		Wet Weather	5.38	0.379	7.89	0.0	21	0.0	0.04	2.2	14
003 - Porter Street Outfall 1	12/13/2011	Dry Weather				<4.0	<5.0	<1.0	<0.05	<10	<10
003 - Porter Street Outfall 2	12/13/2011	Dry Weather				<4.0	<5.0	<1.0	<0.05	30	20
003 - Porter Street Outfall 3[2]	12/13/2011	Dry Weather				<4.0	<5.0	<1.0	0.09	<10	10
003 - Porter Street Outfall Average		Dry Weather				0.0	0.0	0.0	0.03	3.1	5.8
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Daily			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report

Source: Massport

Notes: **Bold** values exceed maximum daily discharge limitation.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 The Porter Street Outfall 1 was not accessible due to construction; therefore samples were not collected from this location.

2 A new sampling location was established for Porter Street Outfall 3 due to ongoing construction. It was sampled for the first time on February 18, 2011.

TSS Total Suspended Solids

NS Not Sampled

Table J-10 Logan Airport 2011 Quarterly Wet Weather Monitoring Results – North, West, Maverick Street, and Porter Street Stormwater Outfalls

		Wet Weather									
	Date	pH (S.U.)	Benzo(a)-anthracene (µg/L)	Benzo(a)-pyrene (µg/L)	Benzo(b)-fluoranthene (µg/L)	Benzo(k)-fluoranthene (µg/L)	Chrysene (µg/L)	Dibenzo(a,h,)-anthracene (µg/L)	Indeno(1,2,3-cd)-pyrene (µg/L)	Naphthalene (µg/L)	Total PAHs (µg/L)
001 - North Outfall	2/25/2011	7.23	<50	<50	<50	<50	<50	<50	<70	<50	ND
002 - West Outfall	2/25/2011	6.89	<50	<50	<50	<50	<50	<50	<70	<50	ND
004 - Maverick Street Outfall	2/25/2011	7.04	<50	<50	<50	<50	<50	<50	<70	<50	ND
003 - Porter Street Outfall 1[1]	2/25/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	2/25/2011	7.04	<10	<10	<10	<10	<10	<10	<14	<10	ND
003 - Porter Street Outfall 3[1]	2/25/2011	7.13	<10	<10	<10	<10	<10	<10	<14	<10	ND
003 - Porter Street Outfall Average		7.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
001 - North Outfall	7/8/2011	8.41	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
002 - West Outfall	7/8/2011	7.86	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
004 - Maverick Street Outfall	7/8/2011	7.55	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall 1[1]	7/8/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	7/8/2011	8.48	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall 3[1]	7/8/2011	8.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall Average		8.49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
001 - North Outfall	9/20/2011	8.00	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
002 - West Outfall	9/20/2011	7.00	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
004 - Maverick Street Outfall	9/20/2011	6.24	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall 1[1]	9/20/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	9/20/2011	8.09	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall 3[1]	9/20/2011	7.85	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall Average		7.97	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
001 - North Outfall	12/15/2011	7.44	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
002 - West Outfall	12/15/2011	7.46	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
004 - Maverick Street Outfall	12/15/2011	7.57	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall 1	12/15/2011	8.05	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall 2	12/15/2011	7.77	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall 3	12/15/2011	7.86	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall Average		7.89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily		6.0 to 8.5	Report	Report	Report	Report	Report	Report	Report	Report	Total

Source: Massport
Notes: **Bold** values exceed maximum daily discharge limitation.
ND Not Detected; NS Not Sampled; PAH Polynuclear Aromatic Hydrocarbons
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit.
1 The Porter Street Outfall 1 and Outfall 3 were not accessible due to construction, therefore samples were not collected from either location. A new sampling location for Outfall 3 was established.

Table J-11 Logan Airport 2011 Quarterly Wet Weather Monitoring Results - Northwest and Runway/Perimeter Stormwater Outfalls

	Date	Maximum Daily Flow (MGD)	Average Quarterly Flow (MGD)	pH (SU)	Oil and Grease (mg/L)	Total Suspended Solids (mg/L)	Benzene (µg/L)
005 - Northwest Outfall	2/25/2011	0.51	0.05	6.64	11	170	<1.0
006- Runway/ Perimeter Outfall (A9)	2/25/2011	0.33	0.04	6.87	<4.4	16	<1.0
006- Runway/ Perimeter Outfall (A17)	2/25/2011	0.11	0.01	6.96	<4.4	5.5	<1.0
006- Runway/ Perimeter Outfall (A19)	2/25/2011	0.04	0.01	6.93	<4.0	6.8	<1.0
006- Runway/ Perimeter Outfall (A21)	2/25/2011	2.46	0.29	6.90	<4.4	40	<1.0
006- Runway/ Perimeter Outfall (A23)	2/25/2011	0.27	0.03	7.00	<4.4	44	<1.0
006- Runway/ Perimeter Outfall (A33)	2/25/2011	0.18	0.03	6.91	<4.4	14	<1.0
006- Runway/ Perimeter Outfall (A38)	2/25/2011	0.33	0.03	7.04	<4.4	66	<1.0
006- Runway/Perimeter Outfall Average		0.53	0.06	6.94	0.0	27	0.0
005 - Northwest Outfall	7/8/2011	0.33	0.02	8.00	<4.4	30	<1.0
006- Runway/ Perimeter Outfall (A9)	7/8/2011	0.16	0.01	8.02	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A15)	7/8/2011	0.07	0.00	8.34	<4.4	9.6	<1.0
006- Runway/ Perimeter Outfall (A19)	7/8/2011	0.03	0.00	8.24	<4.0	200	<1.0
006- Runway/ Perimeter Outfall (A21)	7/8/2011	1.50	0.10	7.47	<4.0	9.6	<1.0
006- Runway/ Perimeter Outfall (A23)	7/8/2011	0.13	0.01	7.82	<4.0	5.1	<1.0
006- Runway/ Perimeter Outfall (A33)	7/8/2011	0.08	0.01	8.10	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A38)	7/8/2011	0.19	0.01	7.63	<4.0	9.7	<1.0
006- Runway/Perimeter Outfall Average		0.31	0.02	7.95	0.0	33	0.0
005 - Northwest Outfall	9/20/2011	0.53	0.05	6.62	<4.0	42	<1.0
006- Runway/ Perimeter Outfall (A9)	9/20/2011	0.26	0.03	8.44	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A15)	9/20/2011	0.11	0.01	8.04	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A17)	9/20/2011	0.11	0.01	7.95	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A21)	9/20/2011	2.12	0.19	6.97	<4.0	12	<1.0
006- Runway/ Perimeter Outfall (A23)	9/20/2011	0.20	0.02	7.12	<4.0	32	<1.0
006- Runway/ Perimeter Outfall (A33)	9/20/2011	0.13	0.02	8.45	<4.0	9.0	<1.0
006- Runway/ Perimeter Outfall (A38)	9/20/2011	0.28	0.02	7.89	<4.0	7.0	<1.0
006- Runway/Perimeter Outfall Average		0.46	0.04	7.84	0.0	8.6	0.0
005 - Northwest Outfall	12/15/2011	0.69	0.063	7.17	<4.4	<5.0	<1.0
006- Runway/ Perimeter Outfall (A9)	12/15/2011	0.341	0.052	7.69	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A18)	12/15/2011	0.052	0.008	7.66	<4.0	14	<1.0
006- Runway/ Perimeter Outfall (A19)	12/15/2011	0.053	0.007	7.30	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A21)	12/15/2011	2.79	0.38	7.46	<4.0	87	<1.0
006- Runway/ Perimeter Outfall (A23)	12/15/2011	0.268	0.040	7.36	<4.4	12	<1.0
006- Runway/ Perimeter Outfall (A33)	12/15/2011	0.235	0.036	7.64	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A38)	12/15/2011	0.351	0.032	7.50	<4.0	17	<1.0
006- Runway/Perimeter Outfall Average		0.585	0.080	7.52	0.0	19	0.0
Discharge Limitations		Report	Report	Report	Report	Report	Report

Source: Massport

Note: Requirements are from NPDES Permit MA 0000787, issued July 31, 2007

Table J-12 Logan Airport 2011 Wet Weather Deicing Monitoring Results – North, West and Porter Street Stormwater Outfalls

	Date	Ethylene Glycol, Total (mg/L)	Propylene Glycol, Total (mg/L)	BOD_5 (mg/L)	COD (mg/L)	Total Ammonia Nitrogen (mg/L of N)	Nonylphenol (µg/L)	4-Methyl-1-H-benzotriazole (µg/L)	5-Methyl-1-H-benzotriazole (µg/L)	Tolytriazole (µg/L)	Whole Effluent Toxicity[1]
001 - North Outfall	1/18/2011	560	890	980	2,400	2.06	<0.30	82.650	91.804	174.454	NS
002 - West Outfall	1/18/2011	690	8,400	7,200	17,000	1.60	<3.2	584.815	803.677	1,388.492	NS
003B - Porter Street 1[2]	1/18/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003B - Porter Street 2	1/18/2011	34	23	93	190	0.195	<0.3	15.674 J	21.708 J	37.382	NS
003B - Porter Street 3[2]	1/18/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003B - Porter Street Outfall Average		34	23	93	190	0.195	0.0	15.674	21.708	37.382	NA
001 - North Outfall	2/1/2011	22	280	320	930	2.65	<0.03	25.930	26.251	52.181	NS
002 - West Outfall	2/1/2011	90	110	340	1,400	1.19	<0.03	21.910	19.666	41.576	NS
003B - Porter Street 1[2]	2/1/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003B - Porter Street 2	2/1/2011	16	75	97	220	0.563	<0.03	6.395	8.158	14.553	NS
003B - Porter Street 3[2]	2/1/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003B - Porter Street Outfall Average		16	75	97	220	0.563	0.0	6.395	8.158	14.553	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily		Report	Report	Report	Report	Report	Report	Report	Report	Report	Report

Source: Massport

Notes: For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit.
J = Value is an estimate calculated by the lab from the response factors of the other two triazole compounds.

1 Whole Effluent Toxicity sample conducted on April 1, 2011.
2 During both deicing events, Porter Street Outfalls 1 and 3 were not sampled due to construction.
BOD_5 Five-day Biochemical Oxygen Demand
COD Chemical Oxygen Demand
NA Not Applicable
ND Not Detected
NS Not Sampled

Table J-13 Logan Airport 2011 Wet Weather Deicing Monitoring Results – Runway/ Perimeter Stormwater Outfalls

	Date	Ethylene Glycol, Total (mg/L)	Propylene Glycol, Total (mg/L)	BOD_5 (mg/L)	COD (mg/L)	Total Ammonia Nitrogen (mg/L of N)	Nonylphenol (µg/L)	4-Methyl-1-H-benzotriazole (µg/L)	5-Methyl-1-H-benzotriazole (µg/L)	Tolytriazole (µg/L)[2]	Whole Effluent Toxicity[1]
006- Runway/ Perimeter (A9)	1/18/2011	<10	<10	<5.0	400	0.659	<0.03	<0.500	<0.500	ND	NS
006- Runway/ Perimeter (A13)	1/18/2011	<10	<10	7.9	650	0.301	0.06	<0.500	<0.500	ND	NS
006- Runway/ Perimeter (A20)	1/18/2011	<10	<10	<10	830	0.510	0.09	<0.500	<0.500	ND	NS
006- Runway/ Perimeter (A21)	1/18/2011	<10	<10	14	710	1.10	<0.03	<0.500	<0.500	ND	NS
006- Runway/ Perimeter (A23)	1/18/2011	<10	<10	<5.0	530	1.05	<0.03	<0.500	<0.500	ND	NS
006- Runway/ Perimeter (A33)	1/18/2011	<10	<10	110	170	4.94	<0.03	71.807	8.015 J	79.822	NS
006- Runway/ Perimeter (A38)	1/18/2011	<10	<10	5.0	390	0.329	2.01	<0.500	<0.500	ND	NS
006- Runway/Perimeter Outfall Average		0.0	0.0	19.6	526	1.270	0.31	10.258	1.145	11.403	NA
006- Runway/ Perimeter (A9)	2/1/2011	<10	22	2.9	80	1.09	<0.03	5.141	0.420 J	5.561	NS
006- Runway/ Perimeter (A13)	2/1/2011	<10	<10	4.0	670	0.460	<0.03	1.225 J	0.316 J	1.541	NS
006- Runway/ Perimeter (A19)	2/1/2011	<10	<10	5.6	650	1.16	<0.03	5.258	<0.100	5.258	NS
006- Runway/ Perimeter (A21)	2/1/2011	<10	<10	5.3	460	1.16	<0.03	2.865 J	0.642 J	3.507	NS
006- Runway/ Perimeter (A23)	2/1/2011	<10	<10	14	470	2.83	<0.03	8.379	1.942 J	10.321	NS
006- Runway/ Perimeter (A33)	2/1/2011	<10	<10	39	230	3.71	<0.0	12.626	4.228 J	16.854	NS
006- Runway/ Perimeter (A38)	2/1/2011	<10	<10	<2.0	570	0.339	<0.03	<0.100	<0.100	ND	NS
006- Runway/Perimeter Outfall Average		0.0	3.1	8.9	447	1.54	0.0	5.071	1.078	6.149	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily		Report	Report	Report	Report	Report	Report	Report	Report	Report	NA

Source: Massport

Notes: For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit.
J = Value is an estimate calculated by the lab from the response factors of the other two triazole compounds.

1 Whole Effluent Toxicity sample conducted on April 1, 2011.
BOD_5 Five-day Biochemical Oxygen Demand
COD Chemical Oxygen Demand
NA Not Applicable
ND Not Detected
NS Not Sampled

Table J-14 Logan Airport Stormwater Outfall NPDES Water Quality Monitoring Results - 1993 to 2011

	1993	1994	1995	1996	1997	1998	1999	2000	2001[1]	2002	2003[1]	2004	2005	2006	2007	2008	2009	2010[1,2]	2011[2]
#/# = Number of samples at or below NPDES limits / Total number of samples taken																			
Oil and Grease (mg/L)																			
North Outfall	30/31	35/36	33/35	29/35	30/35	35/36	29/30	34/36	28/28	36/36	30/32	32/34	33/35	33/33	29/29	23/23	24/24	24/24	24/24
West Outfall	29/30	36/36	34/34	36/36	34/35	36/36	30/30	35/35	27/28	36/36	31/32	33/34	35/35	32/33	28/28	22/23	24/24	24/24	22/24
Porter Street Outfall[2]	30/30	35/36	34/34	36/36	35/35	34/36	30/30	35/36	28/28	34/36	32/32	33/34	34/35	33/33	22/22	50/50	72/72	50/50	49/49
Maverick Street Outfall	29/29	36/36	35/35	36/36	35/35	35/36	30/30	34/34	26/28	35/36	32/32	34/34	35/35	32/33	29/29	22/23	20/21	19/19	23/23
Settleable Solids[3] (mg/L)																			
North Outfall	19/19	34/35	34/35	32/35	31/34	34/36	30/30	34/36	29/29	32/36	32/32	34/34	33/35	32/34	22/22	n/a	n/a	n/a	n/a
West Outfall	19/19	32/36	34/34	35/36	34/34	35/36	29/30	36/36	27/28	36/36	31/32	34/34	32/35	33/33	22/22	n/a	n/a	n/a	n/a
TSS (mg/L)																			
North Outfall	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6/6	24/24	24/24	22/23	24/24
West Outfall	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5/6	24/24	24/24	23/23	22/24
Maverick Street Outfall	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4/6	22/24	20/21	18/19	20/23
pH																			
North Outfall	34/35	33/36	35/35	35/35	35/35	36/36	30/30	36/36	29/29	36/36	32/32	34/34	35/35	34/34	26/26	12/12	16/16	11/11	12/12
West Outfall	34/34	28/36	33/34	35/36	35/35	36/36	30/30	36/36	29/29	36/36	32/32	34/34	35/35	33/33	26/26	12/12	16/16	11/11	12/12
Porter Street Outfall[2]	35/35	30/36	34/34	36/36	35/35	36/36	30/30	36/36	28/28	36/36	32/32	34/34	35/35	33/33	22/22	21/21	48/48	24/24	23/23
Maverick Street Outfall	35/35	35/36	35/35	36/36	34/35	36/36	30/30	35/35	28/28	36/36	32/32	34/34	35/35	33/33	26/26	10/10	16/16	10/10	11/11

Source: Massport

Notes: Sampling requirements changed in 2007 with the issuance of a new NPDES permit. Results through 2007 are based on NPDES Permit MA0000787, issued March 1, 1978. Stormwater outfall water quality monitoring results collected in accordance with the requirements of former NPDES permit. A portion of the Porter Street Drainage Area was incorporated into the West Drainage Area as part of roadway construction projects at Logan Airport.

1 In 2001, 2003, and 2010, exceptional weather, tidal conditions, or insufficient discharge precluded the collection of some samples, leading to a fewer number of samples collected than in other years.

2 In 2010 and 2011, Porter Street Outfall 1 and Porter Street Outfall 3 were not accessible due to construction, leading to a fewer number of samples collected than in other years. A new sampling location was established for Porter Street Outfall 3 and it was sampled for the first time on February 18, 2011. Porter Street Outfall 1 was accessible again in December 2011.

3 Settleable solids analyses were replaced with TSS in 2008.

Table J-15 Logan Airport Oil and Hazardous Material Spills[1] and Jet Fuel Handling - 1990 to 2011

Year	Total Number of all Spills	Total Number of all Spills >10 gallons	Total Volume of all Spills (Gallons)	Estimated Volume of Jet Fuel Handled (Gallons)	Total Volume of Jet Fuel Spilled (Gallons)
1990	173	NA	NA	438,100,000	3,745
1991	186	NA	NA	NA	2,471
1992	195	NA	NA	NA	4,355
1993	188	NA	NA	451,900,000	3,131
1994	217	NA	NA	476,700,000	4,046
1995	161	NA	NA	309,200,000	21,412[2]
1996	159	NA	NA	346,700,000	1,321
1997	147	NA	NA	377,488,161	2,029[3]
1998	191	NA	NA	387,224,004	10,047[4]
1999	196	43	7,151	425,937,051	7,012[5]
2000	136	20	1,318	441,901,932	1,227
2001	139	37	1,924	416,748,819	1,771
2002	101	16	653	358,190,362	559
2003	128	19	10,364	319,439,910	10,188[6]
2004	126	18	894	373,996,141	574
2005	97	15	2,319	368,645,932	585
2006	92	11	752	364,450,864	644
2007	108	7	604	367,585,187	361
2008	99	20	944	345,631,788	662
2009	95	6	1004	327,358,619	915
2010	87	15	476	335,693,997	360
2011	**108**	**12**	**572**	**340,421,373**	**337**

Source: Massport Fire-Rescue Department.
NA Not available.
1 Materials include: jet fuel, hydraulic oil, diesel fuel, gasoline, and other materials such as glycol and paint.
2 One tenant spill, which occurred on October 15, 1995, totaled 18,000 gallons (84 percent of the annual spill total). The spill did not enter the Airport's storm drain system.
3 On October 23, 1997, a fuel line on an aircraft failed, resulting in the release of approximately 2,500 gallons, all but 60 gallons of which were recovered in drums before reaching the ground. Only the 60 gallons is included in the 1997 total.
4 Includes a 7,200-gallon spill that was discovered on September 2, 1998, and a 1,300-gallon spill that occurred on June 3, 1998. Neither spill entered the Airport's storm drain system.
5 Includes a 5,000-gallon spill, none of which entered the Airport's storm drainage system.
6 In 2003, one fuel spill comprised 9,460 gallons or 94 percent of the total volume of the MassDEP/MCP reportable spills that year. The fuel spill was contained and did not enter the drainage system.

Table J-16 Type and Quantity of Oil and Hazardous Material Spills at Logan Airport - 1999 to 2011

	Jet Fuel			Hydraulic Oil			Diesel Fuel			Gasoline			Other		
Year	No. of Spills	Quantity (Gallons)	No. of Spills ≥10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ≥10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ≥10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ≥10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ≥10 Gallons
1999	151	7,012	40	24	67	1	13	49	2	5	7	0	3	16	0
2000	115	1,227	18	8	59	2	3	11	0	8	16	0	2	5	0
2001	104	1,771	32	21	92	3	5	30	1	6	26	1	3	5	0
2002	79	559	15	7	38	0	8	37	1	4	8	0	3	11	0
2003	89	10,188	15	15	91	3	15	30	0	7	24	0	2	31	1
2004	82	574	12	17	189	4	14	52	0	7	26	0	6[1]	53[2]	2[3]
2005	66	585	12	14	78	1	7	1,610	2	7	45	0	3[4]	1	0
2006	65	644	9	10	25	0	6	57	1	4	9	0	7	17	1
2007	66	361	4	16	37	0	16	57	1	3	8	0	7	141[5]	2
2008	74	662	19	15	56	2	5	14	0	1	7	0	4	205[6]	1
2009	95	915	6	21	51	0	9	20	0	3	3	0	11	15	0
2010	54	360	12	17	50	1	5	56	2	2	3	0	7	7	0
2011	**69**	**337**	**10**	**21**	**149**	**1**	**7**	**55**	**1**	**4**	**16**	**0**	**7**	**15**	**0**

Source: Massport

Notes:

1 Includes two Unknown spills (14 gallons), plus one spill of each of the following: Ethylene Glycol, Propylene Glycol, AVGAS, and Paint.

2 Ethylene Glycol (25 gallons), Propylene Glycol (10 gallons), AVGAS (1 gallon) and Paint (3 gallons).

3 One spill of Ethylene Glycol; one spill of Propylene Glycol.

4 Includes two spills of an unknown substance and volume.

5 Includes one spill of motor oil (4 gallons); one spill of kerosene (5 gallons); one spill of cooking oil (120 gallons); one spill of fuel oil (10 gallons); one spill from a battery (1 gallon); two spills of an unknown substance (1 gallon).

6 Includes one spill of transformer oil (200 gallons).

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massport

Massachusetts Port Authority
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East Boston, MA 02128-2090
Telephone (617) 568-5950
www.massport.com

February 15, 2011

Water Technical Unit (SEW)
U.S. Environmental Protection Agency
P.O. Box 8127
Boston, MA 02114

Re: Discharge Monitoring Report
Logan International Airport
NPDES Permit No. MA0000787

To Whom It May Concern:

Enclosed are the Discharge Monitoring Reports (DMRs) for Logan Airport Outfalls for the month of ~~April 2010.~~ January 2011.

As indicated on the attached report, stormwater samples collected from the West Outfall (Outfall 002) were found to have a Total Suspended Solids (TSS) concentration of 230 milligrams per liter (mg/l) and an Oil and Grease (O&G) concentration of 28 mg/l. The permit limit for TSS is 100 mg/l and the limit for O&G is 15 mg/l. The samples were obtained during a wet weather stormwater sampling event on January 18, 2011. Massport was informed of the exceedances on January 24, 2011, by our environmental consultant, Camp Dresser & McKee, Inc. (CDM), following confirmation of the analytical data by the laboratory.

Massport believes the exceedances may be attributable to the amount of precipitation that occurred on the sampling date, including approximately 0.8 inch of rain and 1.9 inches of snow. Prior to the January 18th sampling date, there had been a significant snow event on January 12th (14.6 inches) followed by five days of dry weather. So it is likely that the excessive runoff generated on the sampling date, which included the stormwater and snow melt, carried a higher than normal pollutant loading due to accumulated sediment and other stormwater contaminants such as oil and grease associated with roadways and paved areas.

Massport continues to implement the Best Management Practices included in the Logan Airport Stormwater Pollution Prevention Plan including daily pavement sweeping and maintenance of the pollution control equipment located at the West Outfall and North Outfall.

If you have any questions regarding the current DMRs, please contact me at (617) 568-3552. Thank you.

Sincerely,
Massachusetts Port Authority

James W. Stolecki

James W. Stolecki, P.E.
Senior Environmental Project Manager

Enclosure: Discharge Monitoring Reports

cc: Edward Pawlowski, MADEP NERO
M. Ashan, MADEP NERO
MADEP Division of Watershed Management
Bryan Glascock, City of Boston Environment Department
Leon Bethune, Boston Public Health Commission

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April 15, 2011

Water Technical Unit (SEW)
U.S. Environmental Protection Agency
P.O. Box 8127
Boston, MA 02114

Re: Discharge Monitoring Report
Logan International Airport
NPDES Permit No. MA0000787

To Whom It May Concern:

Enclosed are the Discharge Monitoring Reports (DMRs) for Logan Airport Outfalls for the month of March 2011.

As indicated on the attached report, a stormwater sample collected from the Maverick Outfall (Outfall 004) was found to have a Total Suspended Solids (TSS) concentration of 110 milligrams per liter (mg/l) which exceeds the permit limit for TSS of 100 mg/l. The sample was obtained during a wet weather stormwater sampling event on March 11, 2011. Massport was informed of the exceedances on March 17, 2011, by our environmental consultant, Camp Dresser & McKee, Inc. (CDM), following confirmation of the analytical data by the laboratory.

On March 10, 2011, prior to the exceedance of the TSS discharge limit, Massport had notified its tenants who operate within the Maverick Outfall drainage area to inspect and clean catch basins as required at the end of the winter sanding Massport has confirmed that the tenants have conducted the required inspection and cleaning, and Massport's Facilities Department continues its daily sweeping of all paved areas.

If you have any questions regarding the current DMRs, please contact me at (617) 568-3552. Thank you.

Sincerely,
Massachusetts Port Authority

James W. Stolecki

James W. Stolecki, P.E.
Senior Environmental Project Manager

Enclosure: Discharge Monitoring Reports

cc: Edward Pawlowski, MADEP NERO
MADEP Division of Watershed Management
Bryan Glascock, City of Boston Environment Department
Leon Bethune, Boston Public Health Commission

Massachusetts Port Authority
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Telephone (617) 568-5950
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May 16, 2011

Water Technical Unit (SEW)
U.S. Environmental Protection Agency
P.O. Box 8127
Boston, MA 02114

Re: Discharge Monitoring Report
Logan International Airport
NPDES Permit No. MA0000787

To Whom It May Concern:

Enclosed are the Discharge Monitoring Reports (DMRs) for Logan Airport Outfalls for the month of April 2011.

As indicated on the attached report, stormwater samples collected from the West Outfall (Outfall 002) were found to have a Total Suspended Solids (TSS) concentration of 560 milligrams per liter (mg/l) which exceeds the permit limit for TSS of 100 mg/l, and a Oil & Grease concentration of 24 mg/l which exceeds the permit limit for O&G of 15 mg/l. The samples were obtained during a wet weather stormwater sampling event on April 13, 2011. Massport was informed of the exceedances on April 21, 2011, by our environmental consultant, Camp Dresser & McKee, Inc. (CDM), following confirmation of the analytical data by the laboratory.

Upon being informed of the exceedances, Massport inspected activities within the 450-acre West Outfall drainage area to identify potential sources of the TSS and petroleum detected in the outfall samples. No specific sources were identified. The rainfall event that occurred during the April 13th stormwater sampling generated 1.33 inches of rain and followed a relatively dry month of March. This may account for the increased pollutant loading.

In implementing Best Management Practices in accordance with the Logan Airport Stormwater Pollution Prevention Plan, Massport's Facilities Department conducted a "Spring Cleanup" of all Massport and tenant operated areas. The cleanup, which was initiated on March 21st and extended through April, included the ramp areas adjacent to the airline terminals, areas occupied by the car rental facilities, and roadways and parking areas maintained by Massport. During the cleanup, equipment was moved to facilitate removal of sand and debris that had accumulated during the winter.

If you have any questions regarding the current DMRs, please contact me at (617) 568-3552. Thank you.

Sincerely,
Massachusetts Port Authority

James W. Stolecki

James W. Stolecki, P.E.
Senior Environmental Project Manager

Enclosure: Discharge Monitoring Reports

cc: Edward Pawlowski, MADEP NERO
MADEP Division of Watershed Management
Bryan Glascock, City of Boston Environment Department
Leon Bethune, Boston Public Health Commission

Massachusetts Port Authority
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August 15, 2011

Water Technical Unit (SEW)
U.S. Environmental Protection Agency
P.O. Box 8127
Boston, MA 02114

Re: Discharge Monitoring Report
Logan International Airport
NPDES Permit No. MA0000787

To Whom It May Concern:

Enclosed are the Discharge Monitoring Reports (DMRs) for Logan Airport Outfalls for the month of July 2011. Also enclosed are the Quarterly DMRs for the outfalls.

As indicated on the attached report, a stormwater sample collected from the Maverick Street Outfall (Outfall 004) sampling location was found to have a Total Suspended Solids (TSS) concentration of 370 milligrams per liter (mg/l) which exceeds the permit limit for TSS of 100 mg/l. The sample was obtained during a dry weather sampling event on July 25, 2011. Massport was informed of the exceedances on August 2, 2011, by our environmental consultant, Camp Dresser & McKee, Inc. (CDM), following confirmation of the analytical data by the laboratory.

On August 5th, Massport conducted an inspection of the Maverick Street Outfall drainage area. The 34-acre drainage area is within the Southwest Service Area of Logan Airport which is undergoing construction activity associated with Massport's Consolidated Rental Car Facility (ConRAC) Project. During the inspection, significant quantities of stockpiled soil were observed at the construction site. There was no siltation observed at the outfall. Appropriate sedimentation controls were in place throughout the construction area including: straw wattles around catch basins and at the limits of the work; filter inserts within the catch basins; and ongoing pavement sweeping.

Massport's contractor for the ConRAC Project, Suffolk Construction, inspects the sedimentation controls on a weekly basis in accordance with the project's Construction General Permit issued by the EPA. Massport requested that the contractor replace the catch basin inserts and wattles, and remove any accumulated sediment from the catch basin locations. Massport conducted a follow-up inspection on August 8th and documented that the contractor had replaced the sedimentation controls and removed accumulated sediment. Massport will continue to monitor conditions at the construction site.

If you have any questions regarding the current DMRs, please contact me at (617) 568-3552. Thank you.

Sincerely,
Massachusetts Port Authority

James W. Stolecki

James W. Stolecki, P.E.
Senior Environmental Project Manager

Enclosure: Discharge Monitoring Reports

cc: Edward Pawlowski, MADEP NERO
MADEP Division of Watershed Management
Bryan Glascock, City of Boston Environment Department
Leon Bethune, Boston Public Health Commission

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December 15, 2011

Water Technical Unit (SEW)
U.S. Environmental Protection Agency
P.O. Box 8127
Boston, MA 02114

Re: Discharge Monitoring Report
Logan International Airport
NPDES Permit No. MA0000787

To Whom It May Concern:

Enclosed are the Discharge Monitoring Reports (DMRs) for Logan Airport Outfalls for the month of November 2011.

As indicated on the attached report, a stormwater sample collected from the Maverick Street Outfall (Outfall 004) sampling location was found to have a Total Suspended Solids (TSS) concentration of 150 milligrams per liter (mg/l) which exceeds the permit limit for TSS of 100 mg/l. The sample was obtained during a dry weather sampling event on November 3, 2011. Massport was informed of the exceedance on November 14, 2011, by our environmental consultant, Camp Dresser & McKee, Inc. (CDM), following confirmation of the analytical data by the laboratory.

Current activities within the Maverick Street Outfall drainage area include the construction of Massport's Consolidated Rental Car Facility (ConRAC) Project. Massport forwarded the exceedance notification to the ConRAC field inspectors, Parsons Brinkerhoff Inc., and the project contractor, Suffolk Construction, and requested that they conduct a thorough inspection of the construction area, in addition to their routine weekly NPDES inspection, and also confirm that there was no dewatering occurring that could impact the stormwater drainage system. The inspection identified three (3) catch basin filter inserts that were filled or deteriorated. These deficiencies were subsequently corrected. There was no construction dewatering observed during the inspection that would impact the drainage system.

The ConRAC construction site contains a significant area of exposed soil and large quantities of stockpiled soil. As such, daily monitoring of the site and the Maverick Street Outfall are conducted by the field inspectors to identify and address any deficiencies in stormwater controls.

If you have any questions regarding the current DMRs, please contact me at (617) 568-3552. Thank you.

Sincerely,
Massachusetts Port Authority

James W. Stolecki

James W. Stolecki, P.E.
Senior Environmental Project Manager

Enclosure: Discharge Monitoring Reports

cc: Edward Pawlowski, MADEP NERO
MADEP Division of Watershed Management
Bryan Glascock, City of Boston Environment Department
Leon Bethune, Boston Public Health Commission

Capital Programs and Environmental Affairs

ENVIRONEWS

A Massport Tenant Newsletter

Volume 36, Issue 4

December 2010/ January 2011

INSIDE THIS ISSUE:

EnviroNews is a newsletter published quarterly for Massport Tenants. Your comments and suggestions are welcome—please contact Tricia Haederle (phaederle@massport.com) at 617.568.5963.

KNOW YOUR RESPONSIBILITIES: SPILL REPORTING AND RESPONSE

Massport's Environmental Management Unit reminds everyone that employees, tenants and contractors at Logan Airport are obligated to report all spills of oil, jet fuel, lavatory waste or any oil/hazardous material that they encounter, regardless if they caused the release, and regardless of quantity.

To report a spill, place a call to Massport Fire Alarm (617-567-2020). This quickly mobilizes appropriate resources including Fire Rescue, Environmental Management, Aviation Operations and Massport's spill response contractor. Tenants are encouraged to remind all employees of the importance of early notification and action, which can reduce the cost to clean up a spill, and reduce the magnitude of impact to the environment.

TAKE NOTE!

ALL OIL, HAZARDOUS MATERIAL & LAVATORY WASTE SPILLS AT LOGAN AIRPORT REGARDLESS OF QUANTITY MUST BE REPORTED IMMEDIATELY TO MASSPORT FIRE ALARM 617-567-2020

POROUS ASPHALT IMPROVES STORMWATER QUALITY AT LOGAN AIRPORT

On December 1, the newly relocated cell phone lot was opened to the public at Logan Airport. In addition offering an alternative to driving around the terminal roadways for those waiting to pick up passengers (and thus cutting vehicle emissions), another benefit of this lot goes largely unnoticed: porous pavement allows precipitation to infiltrate into the ground instead of discharging to a storm drain via overland sheet flow. Outwardly, the pavement's appearance is no different than any other asphalt, but it's internal structure provides a route for the stormwater to percolate through to the ground beneath.

"The porous pavement used in the new cell phone lot looks like regular asphalt, but was mixed without some of the particles used in traditional impermeable asphalt," said Sam Sleiman, Massport's Director of Capital Programs and Environmental Affairs. "This allows water to penetrate through the pavement."

Recharging groundwater directly in this manner has several advantages. First, water that would normally enter into the airport's storm drain system (and ultimately discharge

(Continued on page 5)

New Permit Required for All Aboveground Storage Tanks

Even though Above Ground Storage Tanks (ASTs) with a capacity of less than 10,000-gallons are no longer regulated under Massachusetts Storage Tank Regulations, they are still regulated under Massachusetts Fire Regulations governing flammable and combustible liquid storage, and require permitting. Therefore, effective immediately, Massport tenants are required to complete a Massport/Massachusetts Department of Fire Services (DFS) Application & Permit Form for **all** ASTs, used for storage of flammable and combustible liquids on Massport property, regardless of capacity. Please note that this also includes glycol tanks, and mobile tanks. Since Massport Fire Rescue has jurisdiction over ASTs on Massport property, permits must be obtained through them. Permits must be renewed annually, and renewal is the responsibility of the tank owner.

ALL above ground storage tanks on Massport property now require permits, regardless of size. Tanks containing deicing fluid and mobile tanks are also included in this requirement.

Tenants with ASTs have already been contacted by Massport's Environmental Management Unit to begin the permitting process, however, tenants can obtain a blank permit application form from Massport Fire Rescue (617-561-3500) or from Erik Bankey in the Massport Environmental Management Unit (617-568-3514). Tenant owners of ASTs greater than 10,000 gallons capacity must also obtain an annual permit from the DFS. Note that DFS will not issue its permit until the tank owner has been issued the permit by Massport Fire Rescue. Tenants should submit completed forms to Massport Environmental Management Unit; the signed permit will be returned to the tenant who must post it in a conspicuous location at the building listed on the permit.

Contact Erik Bankey at the number above or at ebankey@massport.com for more information.

Tier 2 Reports are Due March 1

The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 establishes requirements for Federal, State and local governments and industry regarding emergency planning and "Community Right-to-Know" reporting on hazardous and toxic chemicals. This law aids communities in meeting their responsibilities in regard to potential chemical emergencies. The Right-to-Know provisions increase knowledge and access to information on the presence of hazardous chemicals in communities and releases of these chemicals into the environment.

Among the key provisions of EPCRA, Sections 311 and 312 require annual submission of chemical inventory data (known as Tier II reports) by facilities to state and local planning officials for incorporation into ongoing emergency planning. Section 313 requires facilities to quantify and submit annual releases of certain chemicals for incorporation into a national data base known as the Toxics Release Inventory (TRI). The primary purpose of the TRI reporting requirement is to assist in research and development of regulations, guidelines and standards relating to routine discharges of chemical materials.

Tier II reports are due electronically on March 1. Instructions on how to submit the inventories can be found on EPA's website at http://www.epa.gov/region1/enforcement/epcra/index.html. Note that EPA is also sponsoring a series of free EPCRA compliance assistance workshops around New England in February. A schedule for these events can be found on the above EPA web page.

Source: USEPA

Eliminating FOD is Everyone's Business

FOD PREVENTION TIPS

CLEAN AS YOU GO—KEEP YOUR WORKSPACE CLEAN

SECURE LOOSE BELONGINGS

TRACK TOOLS, LATEX GLOVES, HAIR NETS, WATER BOTTLES, NEWSPAPERS AND PLASTIC BAGS AROUND YOUR WORK SPACE

SEE FOD? PICK IT UP

DISPOSE OF FOD IN DESIGNATED AIRFIELD BINS OR IN A CLOSED CONTAINER

FOD or Foreign Object Debris, is the term given to any object on an airfield that has the potential to come loose and cause damage, potentially resulting in severe or fatal injuries to personnel and damaging equipment. Damage can include cutting aircraft tires, ingestion into engines or lodging in mechanisms affecting flight operations. Injuries can occur when jet blast propels FOD through the airport environment at high velocities.

FOD creates other problems: it gets washed into the Logan storm sewer system...nearly 70 cubic yards of debris are collected on a weekly basis—that's enough to fill about 100 five gallon buckets.

FOD comes from many sources, such as personnel, airport infrastructure (pavement, lights, and signs), the environment (wildlife, snow, ice) and equipment operating on the airfield (aircraft, airport operations vehicles, maintenance equipment, fueling trucks, other aircraft servicing equipment, and construction equipment). FOD can collect both on and below ground support equipment stored or staged on the airport apron. Jet blast can then blow FOD onto personnel or an aircraft. FOD may also be more prevalent in winter conditions, as pavement infrastructure may be influenced by weathering (freeze and thaw cycles) and begin to crack or break apart.

FOD creates other problems: it gets washed into the Logan storm sewer system. FOD that makes it through the system is collected at stormwater outfalls; nearly 70 cubic yards of debris such as cups, packing peanuts, food wrappers, are collected on a weekly basis—that's enough to fill about 100 five gallon buckets.

Sources: FAA Advisory Circular 150/5210-24, Airport Foreign Object Debris (FOD) Management & Massport

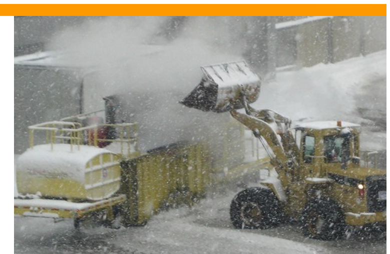
Winter Safety Reminder

RECOGNIZE SLIP & TRIP HAZARDS

- **Weather Induced Conditions**
- **De-Icing Fluid on Surfaces or Shoes**
- **Spills and Melted Snow/Ice**
- **Poor Lighting**
- **Clutter and Obstacles in Walkways**
- **Loose Mats and Carpet**

BE AWARE OF YOUR ENVIRONMENT

- **Take your time and pay attention to where you are going**
- **Walk on designated and cleared paths**
- **Watch your footing and use handrails**
- **Don't carry too much; you can lose your balance or block your view**
- **Anticipate slippery conditions**



Regulatory Round Up

EPA Improves Guidance for Compact Fluorescent Light Bulb Cleanup

In December 2010, the U.S. Environmental Protection Agency (EPA) updated its guidance on how to properly clean up a broken compact fluorescent lamp (CFL). Included with the guidance is a new consumer brochure with CFL recycling and cleanup tips. EPA encourages Americans to use CFLs for residential lighting to save energy and prevent greenhouse gas emissions that lead to global climate change.

CFLs contain a small amount of mercury sealed within the glass tubing. When a CFL breaks, some of the mercury is released as vapor and may pose potential health risks. The guidance and brochure will provide simple, user friendly directions to help prevent and reduce exposure to people from mercury pollution.

More information on the clean up guidance: http://www.epa.gov/cflcleanup
More information on CFLs: www.epa.gov/cfl

Source: USEPA

Commonwealth of Massachusetts Sets Statewide Greenhouse Gas Emissions Limit for 2020

In compliance with the Global Warming Solutions Act (GWSA) signed by Governor Patrick in 2008, Energy and Environmental Affairs (EEA) Secretary Ian Bowles is pleased to announce he has set the statewide greenhouse gas (GHG) emissions limit for 2020 and released the Massachusetts Clean Energy and Climate Plan for 2020 which details how the Commonwealth will comply with the limit. Secretary Bowles set the 2020 limit 25 percent below 1990 levels, the maximum authorized by the GWSA. Building on existing measures that will get Massachusetts much of the way toward the 25 percent limit, the EEA plan comprises a targeted portfolio of additional policies that promise overall cost savings and clean energy jobs, while allowing the Bay State to reach the most ambitious target for GHG reduction of any state in the country.

A complete copy of the Massachusetts Clean Energy and Climate Plan for 2020 can be downloaded from the Executive Office of Energy and Environmental Affairs home page, accessible through www.mass.gov.

Source: MassDEP Bureau of Waste Prevention

MADEP Bans Disposal of Drywall Effective July 1, 2011

The Massachusetts Department of Environmental Protection (MADEP) has banned the disposal of clean gypsum wallboard (drywall) through an amendment to 310 CMR 19.000, the Commonwealth of Massachusetts' Solid Waste Management Regulations. Clean is defined as wallboard that is not coated with paint, joint compound, adhesives, nails or other materials.

During new construction, gypsum wallboard installers generate scrap material. Approximately 15% -20% of new gypsum wallboard is disposed of as scrap. It is estimated that approximately 40,000 tons to 50,000 tons of new gypsum wallboard scrap material is generated annually in Massachusetts.

Since 2001, MassDEP has successfully worked with the construction and demolition (C&D) industry to develop a recycling and reuse infrastructure that can divert this material from disposal. In 2006, Massachusetts became the first state to ban from disposal certain components of the C&D waste stream, specifically asphalt pavement, brick, concrete, metal and wood. There is now a sustainable recycling infrastructure that has a current capacity to recycle approximately 80,000 tons of gypsum wallboard waste material into new gypsum wallboard, with the potential to increase capacity.

Contractors and haulers will have the option to either continue to send mixed C&D to solid waste facilities (i.e. construction and demolition debris processors or transfer stations) that will separate the clean gypsum wallboard material or separate the clean gypsum wallboard scrap material and send it directly to a gypsum recycling facility. Loads with a cumulative total of 20% or less asphalt pavement, brick, concrete, metal, wood and gypsum wallboard will not be considered failed loads. In addition, pieces of clean gypsum wallboard with dimensions of two square feet or less are exempt from the disposal ban.

For more information on the upcoming disposal ban, background information and locations of disposal facilities in Massachusetts, visit the MADEP website at:

http://www.mass.gov/dep/recycle/laws/regulati.htm#bans

Source: MADEP

MADEP Snow Disposal Guidance

The Massachusetts Department of Environmental Protection (MADEP) has developed guidelines is to help businesses dispose of snow appropriately. Snow that is contaminated with road salt, sand, litter, and other pollutants threatens public health and the environment. As snow melts, pollutants are transported into surface water or through the soil where they may eventually reach the groundwater, contaminating water supplies impacting aquatic life. Sand washed into water bodies can create sand bars or fill in wetlands and ponds, causing flooding. The following are highlights from the MADEP guidelines. Please see the MADEP website at http://www.mass.gov/dep/water/laws/snowdisp.htm for the complete guidance:

MADEP recommends that you avoid dumping snow into any water body, including the ocean. Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage swales or ditches. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment and litter released from melting snow also may be quickly transported through the system into surface water. Debris should be cleared from the site prior to using the site for snow disposal, and debris should be removed from the site at the end of the season (no later than May 15).

Under extraordinary conditions, when all land-based snow disposal options are exhausted, disposal of snow may be allowed in certain water bodies under certain conditions. In these dire situations, notify your local Conservation Commission and the appropriate MassDEP Regional Service Center before disposing of snow in a waterbody:

Northeast Regional Office, Wilmington, 978-694-3200/Southeast Regional Office, Lakeville, 508-946-2714 or Central Regional Office, Worcester, 508-792-7683

Source: MADEP

Porous Pavement (Cont'd)

(Continued from page 1)

to Boston Harbor) directly recharges the groundwater. This replenishes groundwater base flow and provides more water for the root zones of plants. Recharging stormwater close to its point of origin is advantageous as it mimics the natural drainage patterns in the absence of development.

Second, any debris or contaminants that may be entrained in the runoff, such as oil and grease, can be trapped within the pores of the pavement, or can adhere to the soil where biodegradation, adsorption or other natural processes can work to reduce their concentrations. To remove debris entrained n the pavement and to maintain its porosity, it will need to be vacuum swept—an increased maintenance need over traditional pavement.

The size of the new Cell Phone Lot is about 20,000 square feet. The cost of paving it with porous pavement was approximately 1.5 times more expensive than traditional mix due to the composition of the mix itself (more liquid asphalt and additives), and the additional base layers required.

POROUS PAVEMENT BENEFITS

- FLOOD CONTROL
- WATER QUALITY TREATMENT
- GROUNDWATER RECHARGE
- REDUCED SAND/SALT USE DUE TO LOW OR NO ICE DEVELOPMENT
- MAINTAINS TRACTION WHEN WET
- REDUCED ROADWAY NOISE
- REDUCED INFRASTRUCTURE (CATCH BASINS, CURBING, ETC.)

SOURCE: UNH Stormwater Center, www.unh.edu/erg/cstev/

SEE A SPILL? REPORT IT.

REPORTING COSTS NOTHING

INACTION CAN COST A FORTUNE

Report ALL fuel, oil, hazardous materials or lavatory waste spills within 2 hours of discovery at Logan Airport to Massport Fire Alarm 617-567-2020

Capital Programs and Environmental Affairs

ENVIRONEWS

A Massport Tenant Newsletter

Volume 37, Issue 1
May 2011

INSIDE THIS ISSUE:

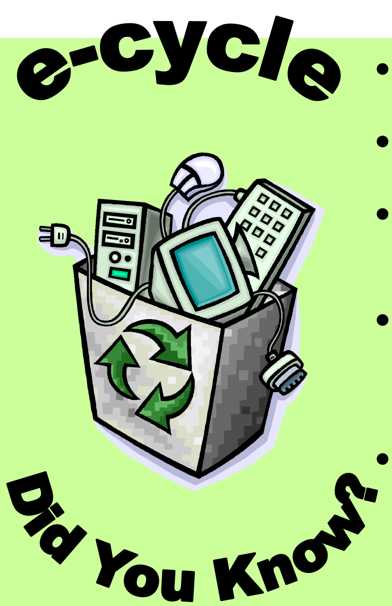
EnviroNews is a newsletter published four times a year for Massport Tenants. Your comments and suggestions are welcome—please contact Tricia Haederle (phaederle@massport.com) at 617.568.5963.

Massport Hazardous Waste Collection Nets Over 27,000 Pounds of Materials

Massport celebrated the 41st anniversary of Earth Day by sponsoring a free hazardous waste collection event at Logan Airport on April 21 and at Hanscom Field on May 10. Open to all tenants, their employees and Massport employees, the event resulted in the collection of over 27,000 pounds of hazardous and related materials.

"This collection effort will properly dispose of hazardous materials and make the airport environment safer and cleaner as well as making the homes of airport employees safer as well," said Sam Sleiman, Director of Capital Programs and Environmental Affairs. "Massport is working with a private contractor to dispose of all the material in licensed facilities."

The largest amount of reclaimed materials by weight were electronics or "e-waste". A total of approximately 14,900 pounds of televisions, computers, monitors and printers were collected at both Hanscom and Logan. This accounted for over 53% of the materials collected. See below for the importance of recycling this valuable resource.



- Recycling one million laptops saves the energy equivalent to the electricity used by 3,657 US homes in a year.
- Almost all of the materials used to manufacture a cell phone can be recovered to make new products.
- For every million cell phones we recycle, 35,274 pounds of copper, 772 pounds of silver, 75 pounds of gold, and 33 pounds of palladium can be recovered.
- Electronics contain precious metals, copper, and plastics—all of which require energy to mine and process. Recycling avoids mining & processing new materials, conserving natural resources and avoiding air and water pollution and greenhouse gas emissions.
- Socially responsible recycling: If a cell phone is in good working condition, some collection programs donate them to a charity, provide them for sale to those who need them, or donate the proceeds of the sale to worthwhile causes.

Source: USEPA

MISSED MASSPORT'S HAZARDOUS WASTE COLLECTION EVENTS?

TRY THESE OPTIONS

Download the FREE iRecycle application for your smartphone and find another collection location near you. iRecycle provides access to more than 800,000 recycling and disposal resources for more than 240 materials. Links to the application are available at **http://Earth911.com/irecycle/**. You can also search for collection locations online by zip code or city at **http://Earth911.com**.

Electronics Recycling: Over ten locations in Massachusetts and New Hampshire accept Mitsubishi, Panasonic, Quasar, Sharp, Visio, Toshiba and Technics brand electronics at no charge (restrictions may apply), and other brands for a fee. Go to: **http://www.mrmrecycling.com/collection_ne.htm**

The Telecommunications Industry Association's **E-cycling Central** website **http://www.ecyclingcentral.com/** offers an updated **calendar of recycling and collection events in your area**, a list of Frequently Asked Questions, and links to other disposal options for items such as batteries and light bulbs.

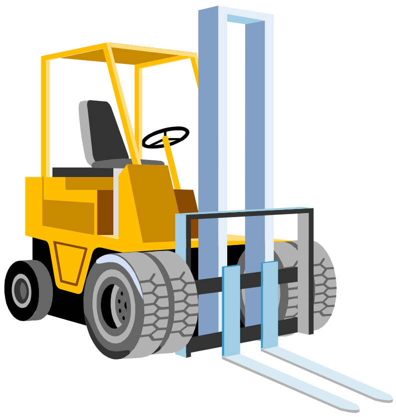
Check it Out! A 30 Second Solution for Leaks and Spills

We all know that sometimes equipment leaks just happen. Aging ground service equipment (GSE) is commonplace, often heavily used, by a multitude of operators, from one shift to another, day after day. It is for this reason that **doing an equipment check** before engine start up and driving off to the next destination is an essential and solid business practice.

It is as easy as doing a quick walk around and taking a careful look under the equipment to check for drips and puddles, **all in 30 seconds or less**. Don't have the 30 seconds to spare? Think about this – you get into your GSE, drive from the terminal to the hangar, park, get out, and realize that the GSE has just left a trail of hydraulic fluid from originating point to the final destination. You now have the responsibility of contacting Fire Alarm and mobilizing the emergency cleanup crew and may have possibly triggered state and federal environmental notification and cleanup requirements. It also happens to be during peak hours so that numerous other vehicles have driven through the leaked fluid and the release has just spread here, there and everywhere. It takes numerous and costly labor hours to clean up the spill, the magnitude of which could have been minimized by a careful 30 second inspection. Incorporating a simple inspection protocol as part of your standard operating procedure goes a long way in optimizing your time for all the important things that you do.

-Rosanne Joyce, Massport Senior Environmental Project Manager

Information Session on Hoisting Licenses



Massport will be hosting a hoisting license information session for its employees, tenants and contractors , presented by Department of Public Safety (DPS) staff, on Tuesday, June 21, 2011, in the Logan Media Room at 10 am. DPS is the state agency responsible overseeing the issuance of hoisting licenses. DPS staff will briefly review regulations and license requirements, followed by a question and answer session. This presentation will take place during the regular monthly meeting of the Airside Safety Alliance, and is open to any interested party. Offered at no charge, there is no RSVP required. If you have any questions regarding the meeting or hoisting licensure, please contact Brian Dinneen, Massport Safety Manager, at 617-568-7427 or bdinneen@massport.com.

Anyone operating hoisting equipment in Massachusetts, including at Logan Airport, must obtain a license from the Massachusetts Department of Public Safety (DPS). This includes those individuals operating excavators, forklifts, snow removal equipment and other machinery where the:

- height of the lift exceeds ten feet <u>or</u>
- weight of the load exceeds 500 pounds <u>or</u>
- capacity of the bucket exceeds 1/4 cubic yard capacity

Hoisting operators must be 18 years of age and successfully pass an examination covering all working parts of the hoisting machinery, safe operating practices, hand signals, and inspection procedures in order to obtain a license. Additional information on licensing requirements, exams and Frequently Asked Questions can be found on the DPS website, which can be accessed at **http://www.Mass.gov/dps** .

HOISTING LICENSE QUESTIONS?

DPS Information Session

Tuesday, June 21

Logan Media Room

10 am

For All Employees, Tenants & Contractors

Flammable Storage Permits

In order to store flammable and/or combustible liquids at Logan Airport, **including in approved flammable storage cabinets**, permits must be obtained from Massport Fire Rescue. Logan tenants and Massport personnel can pick up an application in the front lobby (street side) of Massport Fire Rescue located at 162 Harborside Drive. Complete and sign the permit and leave it in the Permits for Approval box in the Fire Rescue lobby. Once issued, Fire Rescue will deliver the permit to your location and review your storage. Please note that these permits do not expire and are offered without a fee. Massport Fire Rescue also offers tenants a free fire safety inspection of their lease areas. To arrange an inspection, or if you have questions, contact Captain Jay Drumm of Massport Fire Rescue at 617-561-3415.

Use an air freshener.
Taking mass transit, biking, or walking to work, school, or the store can save you money, plus help to reduce traffic congestion and pollution. So keep it up, because —
It all adds up to cleaner air
U.S. Department of Transportation
Federal Highway Administration
massport

Capital Programs and Environmental Affairs

ENVIRONEWS

A Massport Tenant Newsletter

Volume 37, Issue 3

December 2011/ January 2012

INSIDE THIS ISSUE:

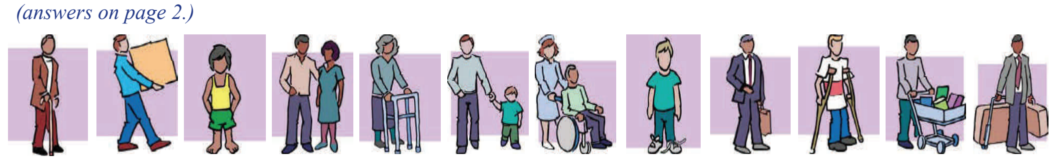
EnviroNews is a newsletter published quarterly for Massport Tenants. Your comments and suggestions are welcome—please contact Brenda Enos (benos@massport.com) at 617.568.5963.

Ride Escalators Responsibly

The first patent for an escalator type machine was granted in March of 1859 to Nathan Ames of Saugus, Massachusetts that he called Revolving Stairs. He was ahead of his time and a prototype was not built until Jesse Reno introduced a working escalator as a new ride at Coney Island, NY in 1896. Logan Airport currently has 65 escalators and 24 moving walkways available to assist tens of thousands of customers per day who navigate the airport. Although common, many customers and employees can ride escalators improperly leading to injury.

It's Easy to Be Safe

You can help avoid accidents by using an elevator under certain conditions. Put an X through the boxes below which show people who should **not** *be using an escalator.*
(answers on page 2.)



1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12.

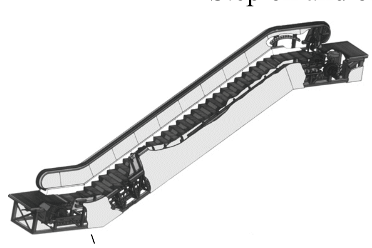
Follow these safety tips and enjoy a safe ride!

Before entering escalators:

- No canes, walkers, wheeled vehicles, carts or large bags.
- Don't ride barefoot or with loose shoelaces.
- Check the direction of the moving steps.

When entering escalators:

- Step on and off promptly. Take care if you are wearing bifocals.



- Hold children or small packages firmly with one hand.
- Grasp the handrail as you step promptly onto the moving step.
- Stand toward the middle of the step away from the sides and face forward.
- Keep loose clothing clear of steps and sides.
- Keep a firm grip on the handrail
- Reposition your hand slowly if the handrail moves ahead or behind the steps.

(Continued on page 2)

Reporting Corner

Tier 2 Reports are Due March 1

The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 establishes requirements for Federal, State and local governments and industry regarding emergency planning and "Community Right-to-Know" reporting on hazardous and toxic chemicals. This law aids communities in meeting their responsibilities in regard to potential chemical emergencies. The Right-to-Know provisions increase knowledge and access to information on the presence of hazardous chemicals in communities and releases of these chemicals into the environment.

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Tier II reports are due electronically on March 1. Instructions on how to submit the inventories can be found on EPA's website at http://www.epa.gov/region1/enforcement/epcra/workshops.html. Note that EPA is also sponsoring a series of free EPCRA compliance assistance workshops around New England in January and February. A schedule can be found on the above EPA web page.

Large Quantity Hazardous Waste Generator Biennial Reporting Due March 1

In accordance with Massachusetts Hazardous Waste regulations, large quantity generators who transport or offer for transportation any hazardous waste off the site of generation shall prepare and submit a copy of a Biennial Report. The report is due March 1st of each even-numbered year (2012) for activities during the previous year (2011). EPA form 8700-13A can be found on EPA's website.

Ride Escalator Responsibly

(Continued from page # 1)

- Don't rest your handbag or parcels on the handrail.
- Pay attention. Don't window-shop or sight see while riding.
- Don't lean against the side.

When exiting escalators

- Don't hesitate. Step off promptly.
- Immediately move clear of the escalator exit area — don't stop to talk or look around. Other passengers may be behind you.

Answer from above: Customers and employees numbered 1, 2, 3, 5, 7, 8, 10, 11 and 12 should choose the elevator.

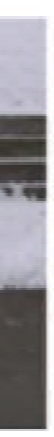
Top 10 2011 OSHA Citations

OSHA has published data on its most frequently cited standards, for fiscal year 2011 (October 2010 through September 2011). The results show that the "Top 10" most frequently cited standards make up almost 44 percent of the citations issued with fall protection in construction and hazard communication in general industry leading the way.

Top 10 most frequently cited standards:

1. Duty to have fall protection, construction (29 CFR 1926.501)
2. Scaffolds, general requirements, construction (29 CFR 1926.451)
3. Hazard communication standard, general industry (29 CFR 1910.1200)
4. Respiratory protection, general industry (29 CFR 1910.134)
5. Control of Hazardous energy (lockout/tagout), general industry (29 CFR 1910.147)
6. Electrical, wiring methods, components and equipment, general industry (29 CFR 1910.305)
7. Ladders, construction (29 CFR 1926.l053)
8. Powered industrial trucks, general industry (29 CFR 1910.178)
9. Electrical systems design, general requirements, general industry (29 CFR 1910.303)
10. Machines, general requirements, general Industry (29 CFR 1910.212)

Road Salt Alternatives



According to the National Research Council (NRC), road-salt use in the United States ranges from 8 million to 12 million tons of NaCl per year. Road Salt is a very effective method to help keep our roadways clear of ice during winter months; however, recent studies have shown that 55% of chlorine in road salt is being washed from the roads, driveways and sidewalks through storm water runoff and into rivers where it can be toxic to fish, other aquatic life and plants as well. Try these tips for keeping your driveway and sidewalk clear and dry this winter.

- **Shovel or plow first.** Removing snow buildup means using less salt and makes it more effective.
- **Use salt, deicers and abrasives only where needed,** such as on slopes or in high traffic areas.
- **Consider using only abrasives** (sand, sawdust or cat litter) to create traction. Sweep them up in the spring to keep them from washing away and becoming a pollutant.
- **Apply deicers evenly** using a broadcast spreader instead of by the handful (see photo).
- **Choose round pellets.** They reach the icy surface faster.
- **Read labels.** Know what you are applying and the effects of exposure. Some deicing chemicals corrode metal or harm pets.

MADEP Snow Disposal Guidance — Annual Reminder

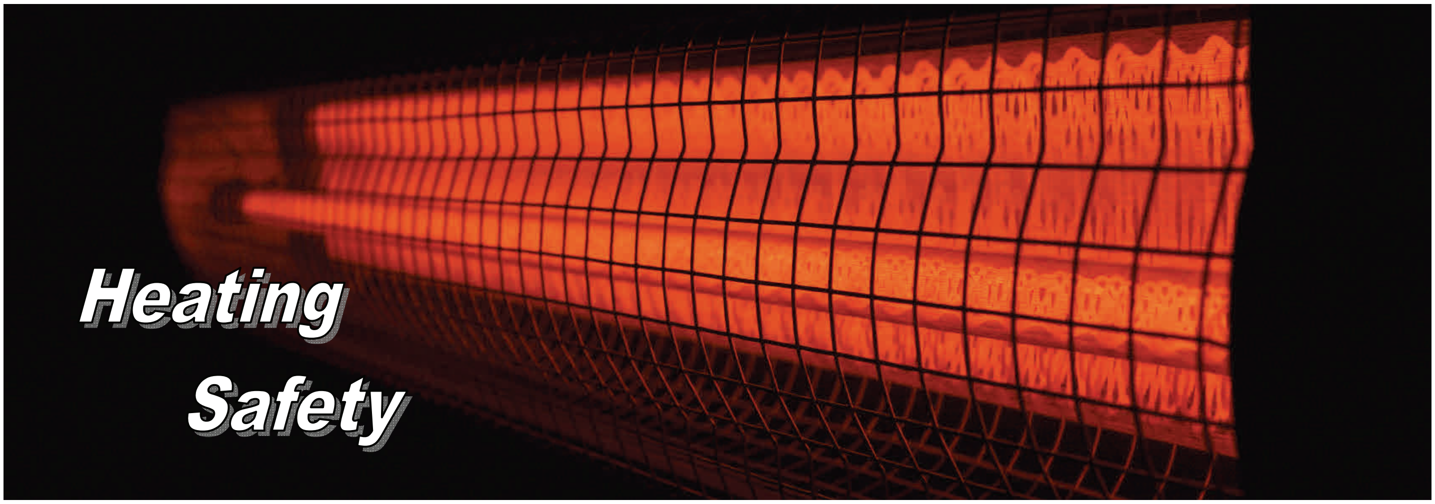
The Massachusetts Department of Environmental Protection (MADEP) has developed guidelines to help businesses dispose of snow appropriately. Snow that is contaminated with road salt, sand, litter, and other pollutants threatens public health and the environment. As snow melts, pollutants are transported into surface water or through the soil where they may eventually reach the groundwater, contaminating water supplies impacting aquatic life. Sand washed into water bodies can create sand bars or fill in wetlands and ponds, causing flooding. The MADEP website at http://www.mass.gov/dep/water/laws/snowdisp.htm has the complete guidelines:

MADEP recommends that you avoid dumping snow into any water body, including the ocean. Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage swales or ditches. Debris should be cleared from the site prior to using the site for snow disposal, and debris should be removed from the site at the end of the season (no later than May 15).

Under extraordinary conditions, when all land-based snow disposal options are exhausted, disposal of snow may be allowed in certain water bodies under certain conditions. In these dire situations, notify your local Conservation Commission and the appropriate MassDEP Regional Service Center before disposing of snow in a waterbody:

Northeast Regional Office, Wilmington, 978-694-3200/Southeast Regional Office, Lakeville, 508-946-2714 or Central Regional Office, Worcester, 508-792-7683

Source: MADEP



There is something about the winter months and curling up with a good book by the fireplace. But did you know that heating equipment is a leading cause of home fire deaths? Here are a few safety tips and precautions that will help you prevent most heating fires from happening.

- Keep anything that can burn at least three-feet away from heating equipment, like the furnace, fireplace, wood stove, or portable space heater.
- Have a three-foot “kid-free zone” around open fires and space heaters.
- Never use your oven or stovetop to heat your home.
- Have a qualified professional install stationary space heating equipment, water heaters or central heating equipment according to the local codes and manufacturer’s instructions.
- Have heating equipment and chimneys cleaned and inspected every year by a qualified professional.
- Remember to turn portable heaters off when leaving the room or going to bed.
- Make sure the fireplace has a sturdy screen to stop sparks from flying into the room. Ashes should be cool before putting them in a metal container. Keep the container a safe distance away from your home.
- Test smoke alarms monthly.
- Install a spark arrestor on top of your chimney to keep sparks from starting a fire on your roof or outside your home.
- Burn only well seasoned wood in a fireplace or wood stove. Use paper or kindling to start the fire-not flammable liquids. And do not use artificial logs in wood stoves.
- Place portable generators outside your home and away from windows, doors or vents. Also keep clear from trees or leaves.

FACT

Half of home heating fires are reported during the months of **December**, **January** and **February**.

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2012 Peak Period Pricing Monitoring Report

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BOSTON-LOGAN INTERNATIONAL AIRPORT MONITORING REPORT ON SCHEDULED AND NON-SCHEDULED FLIGHT ACTIVITY

Peak Period Surcharge Regulation
740 CMR 27:00: Massachusetts Port Authority

Report Number:	**009**
Monitoring Period:	**Through Sept. 2012**
Report Issue Date:	**May 2012**

Note: This report reflects the Boston-Logan Airport flight activity monitoring under 740 CMR 27.03 Peak Period Surcharge Regulation on Aircraft Operations at Boston-Logan International Airport.

Findings: This report includes actual and projected activity data through September 2012. Current and projected near-term flight levels at Boston Logan are well below Logan's good weather (VFR) throughput of approximately 120 flights per hour. **As a result, average VFR delays are projected to be minimal and well below the 15 minutes threshold through September 2012.**

In the event demand conditions at the airport change significantly from the current projection, Massport will issue updates to this report.

Attachments

Table 1: Summary Overview of Peak Period Surcharge Program

Table 2: Summary Overview of Forecast Methodology

Table 3: Projected Aircraft Operations at Logan Airport Projected

Table 4: Projected Hourly Operations, Average Weekday

Table 5: Forecast Logan Average Weekday Operations

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Table 1: Summary Overview of Peak Period Surcharge Program

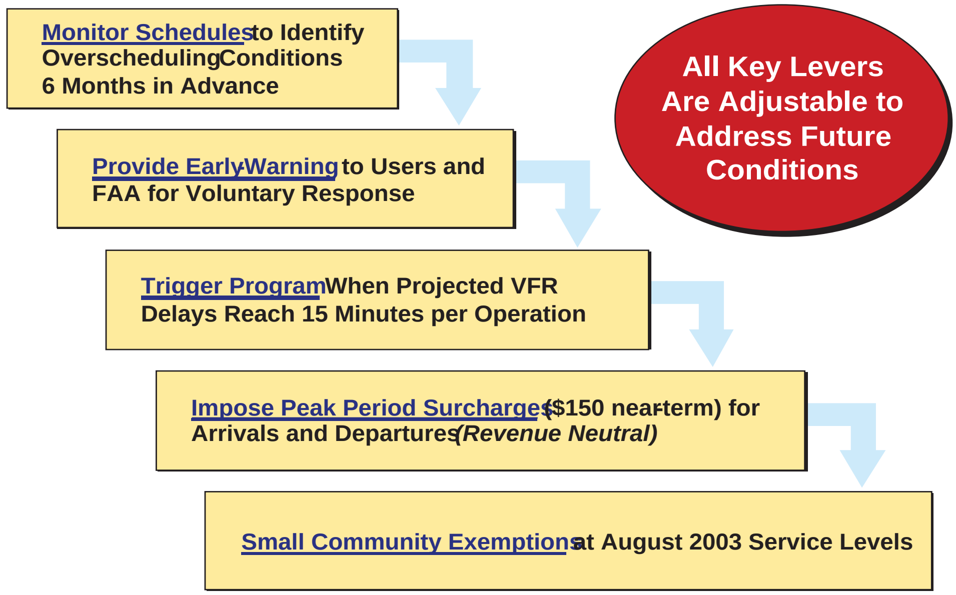
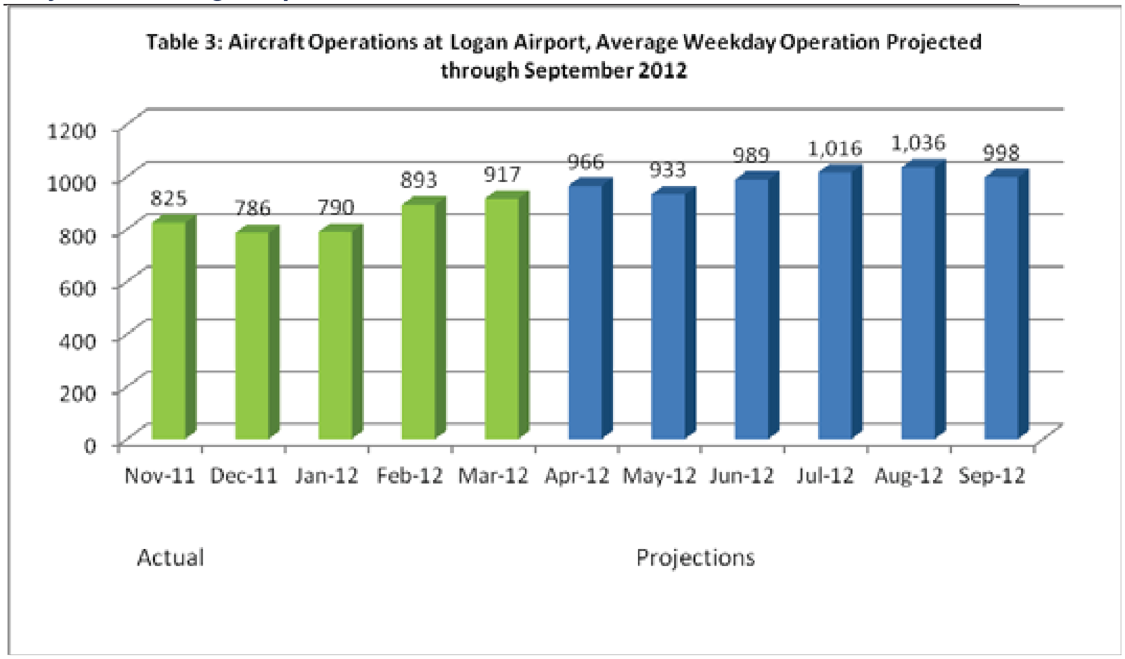


Table 2: Summary Overview of Forecast Methodology

- Scheduled passenger airline flights represent more than 93 percent of total aircraft operations. Passenger airline activity for the Spring and Summer periods were projected based on published advance airline schedules
- Forecasts of monthly activity for other segments (GA, Cargo, Charter) are based on the past three months of actual flight volume and historic patterns of monthly seasonality
- Day-of-week and time of day distributions for non-scheduled segments are based on analysis of Logan radar data
- Projections for each segment were combined to produce the forecast pattern of hourly flight activity for an average weekday, Saturday, and Sunday for the period from February through September

Table 3: Aircraft Operations at Logan Airport, *Average Weekday Operations Projected Through September*



Actual	Projections

Note: Actual Operations are based on Massport data/air carrier reports and reflect flight cancellations due to weather and other operational impacts.

Table 4: Projected Hourly Operations, *Average Weekday, August*

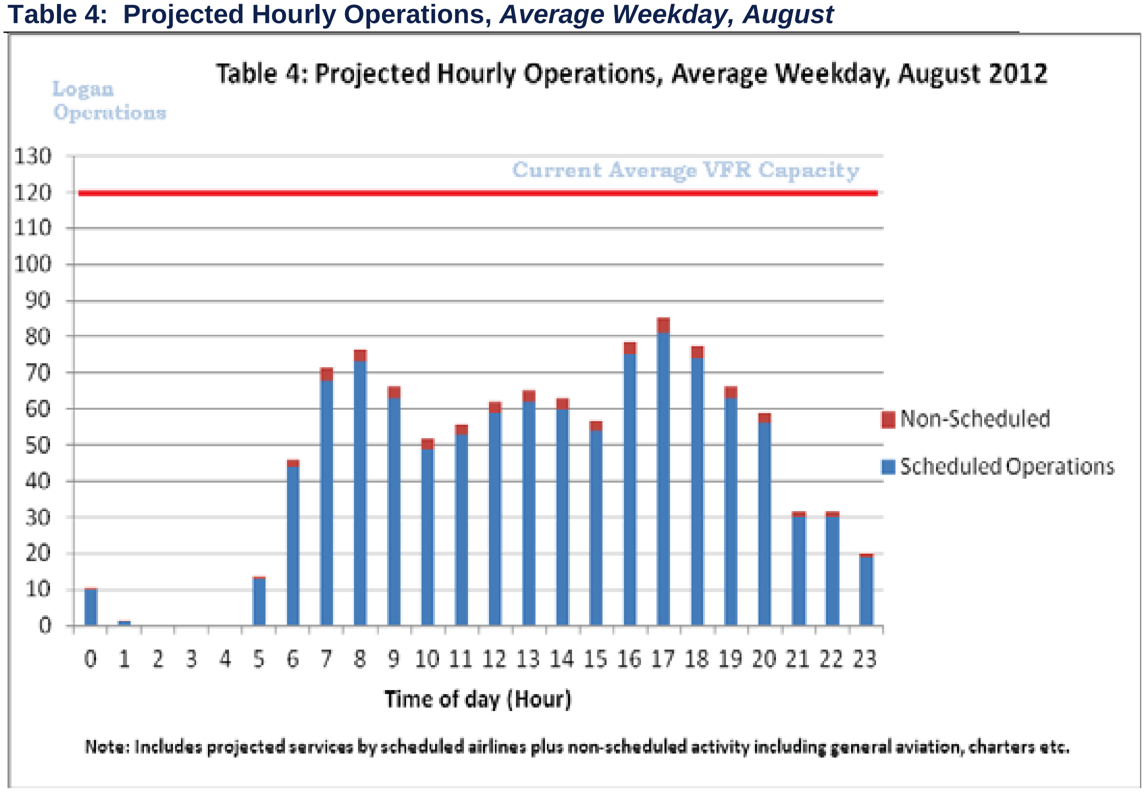


Table 5: Forecast Logan Average Weekday Operations, *Feb. – Sep.*

Forecast Daily Operations								
Hour Range	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12
0	5	5	8	7	9	9	10	0
1	1	2	1	1	1	1	1	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	12	12	15	11	14	15	13	12
6	39	43	43	41	44	43	44	69
7	57	60	58	59	62	66	68	73
8	65	68	70	66	71	71	73	90
9	59	57	59	59	63	63	63	74
10	43	45	50	48	43	50	49	46
11	42	44	47	49	54	54	53	52
12	47	46	49	49	46	52	59	53
13	54	57	59	55	66	64	62	55
14	45	50	54	52	53	56	60	64
15	52	48	49	49	50	53	54	56
16	67	63	64	65	69	73	75	61
17	72	72	78	74	83	81	81	84
18	71	73	75	69	70	73	74	70
19	55	58	60	63	61	60	63	73
20	43	47	50	50	54	57	56	40
21	29	32	30	21	26	28	30	14
22	21	21	28	30	30	31	30	11
23	12	17	18	16	18	18	19	2
Total	**893**	**917**	**965**	**933**	**989**	**1,016**	**1,035**	**998**

Note: Activity for Feb and March is actual traffic not projected.

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Demonstration of Reduced Airport Congestion through Pushback Rate Control

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DEMONSTRATION OF REDUCED AIRPORT CONGESTION THROUGH PUSHBACK RATE CONTROL

This report is based on the paper submitted to the
Ninth USA/EUROPE Air Traffic Management R & D Seminar

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Abstract

Airport surface congestion results in significant increases in taxi times, fuel burn and emissions at major airports. This paper presents the field tests of a control strategy to airport congestion control at Boston Logan International Airport. The approach determines a suggested rate to meter pushbacks from the gate, in order to prevent the airport surface from entering congested states and reduce the time that flights spend with engines on while taxiing to the runway. The field trials demonstrated that significant benefits were achievable through such a strategy: during eight four-hour tests conducted during August and September 2010, fuel use was reduced by an estimated 12,000-15,000 kg (3,900-4,900 US gallons), while aircraft gate pushback times were increased by an average of only 4.3 minutes.

1 Introduction

Aircraft taxiing on the surface contribute significantly to the fuel burn and emissions at airports. The quantities of fuel burned, as well as different pollutants such as Carbon Dioxide, Hydrocarbons, Nitrogen Oxides, Sulfur Oxides and Particulate Matter, are proportional to the taxi times of aircraft, as well as other factors such as the throttle settings, number of engines that are powered, and pilot and airline decisions regarding engine shutdowns during delays.

Airport surface congestion at major airports in the United States is responsible for increased taxi-out times, fuel burn and emissions [1]. Similar trends have been noted in Europe, where it is estimated that aircraft spend 10-30% of their flight time taxiing, and that a short/medium range A320 expends as much as 5-10% of its fuel on the ground [2]. Domestic flights in the United States emit about 6 million metric tonnes of CO_2, 45,000 tonnes of CO, 8,000 tonnes of NOx, and 4,000 tonnes of HC taxiing out for takeoff; almost half of these emissions are at the 20 most congested airports in the country. The purpose of the Pushback Rate Control Demonstration at Boston Logan International Airport (BOS) was to show that a significant portion of these impacts could be reduced through measures to limit surface congestion.

A simple airport congestion control strategy would be a state-dependent pushback policy aimed at reducing congestion on the ground. The *N-control* strategy is one such approach, and was first considered in the Departure Planner project [3]. Several variants of this policy have been studied in prior literature [4, 5, 6, 7]. The policy, as studied in these papers, is effectively a simple threshold heuristic: if the total number of departing aircraft on the ground exceeds a certain threshold, further pushbacks are stopped until the number of aircraft on the ground drops below the threshold. By contrast, the *pushback rate control* strategy presented in this paper does not stop pushbacks once the surface is in a congested state, instead it regulates the rate at which aircraft pushback from their gates during high departure demand periods so that the airport does not reach undesirably high congested states.

1.1 Motivation: Departure throughput analysis

The main motivation for our proposed approach to reduce taxi times is an observation of the performance of the departure throughput of airports. As more aircraft pushback from their gates onto the taxiway system, the throughput of the departure runway initially increases because more aircraft are available in the departure queue, but as this number, denoted as N, exceeds a threshold, the departure runway capacity becomes the limiting factor, and there is no additional increase in throughput. We denote this threshold as N^*. This behavior can be further parameterized by the number of arrivals. The dependence of the departure throughput with the number of aircraft taxiing out and the arrival rate is illustrated for a runway configuration in Figure 1 using 2007 data from FAA's Aviation System Performance Metrics (ASPM) database. Beyond the threshold N^*, any additional aircraft that pushback simply increase their taxi-out times [8]. The value of N^* depends on the airport, arrival demand, runway configuration, and meteorological conditions. During periods of high demand, the pushback rate control protocol regulates pushbacks from the gates so that the number of aircraft taxiing out stays close to a specified value, N_{ctrl}, where $N_{\text{ctrl}} > N^*$, thereby ensuring that the airport does not reach highly-congested states. While the choice of N_{ctrl} must be large enough to maintain runway utilization, too large a value will be overly conservative, and result in a loss of benefits from the control strategy.

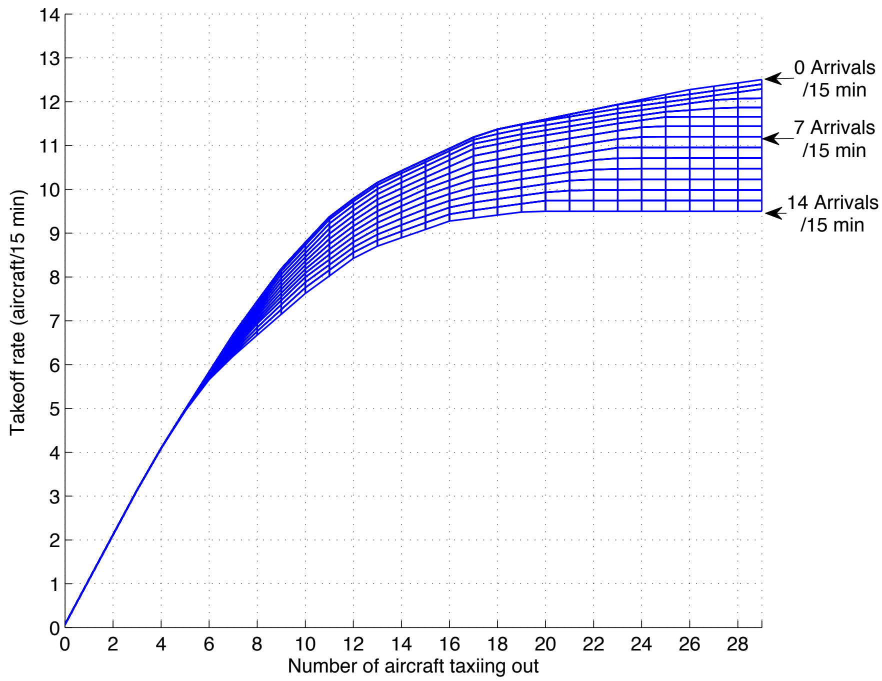

Figure 1: Regression of the departure throughput as a function of the number of aircraft taxiing out, parameterized by the arrival rate for 22L, 27 | 22L, 22R configuration, under VMC [9].

2 Design of the pushback rate control protocol

The main design consideration in developing the pushback rate control protocol was to incorporate effective control techniques into current operational procedures with minimal controller workload and procedural modifications. After discussions with the BOS facility, it was decided that suggesting a rate of pushbacks (to the BOS Gate controller) for each 15-min period was an effective strategy that was amenable to current procedures.

The two important parameters that need to be estimated in order to determine a robust control strategy are the N^* threshold and the departure throughput of the airport for different values of N. These parameters can potentially vary depending on meteorological conditions, runway configuration and arrival demand (as seen in Figure 1), but also on the fleet mix and the data sources we use.

2.1 Runway configurations

BOS experiences Visual Meteorological Conditions (VMC) most of the time (over 83% of the time in 2007). It has a complicated runway layout consisting of six runways, five of which intersect with at least one other runway, as shown in Figure 2. As a result, there are numerous possible runway configurations: in 2007, 61 different configurations were reported. The most frequently-used configurations under VMC are 22L, 27 | 22L, 22R; 4L, 4R | 4L, 4R, 9; and 27, 32 | 33L, where the notation 'R1, R2 | R3, R4' denotes arrivals on runways R1 and R2, and departures on R3 and R4. The above configurations accounted for about 70% of times under VMC.

We note that, of these frequently used configurations, 27, 32 | 33L involves taxiing out aircraft across active runways. Due to construction on taxiway "November" between runways 15L and 22R throughout the

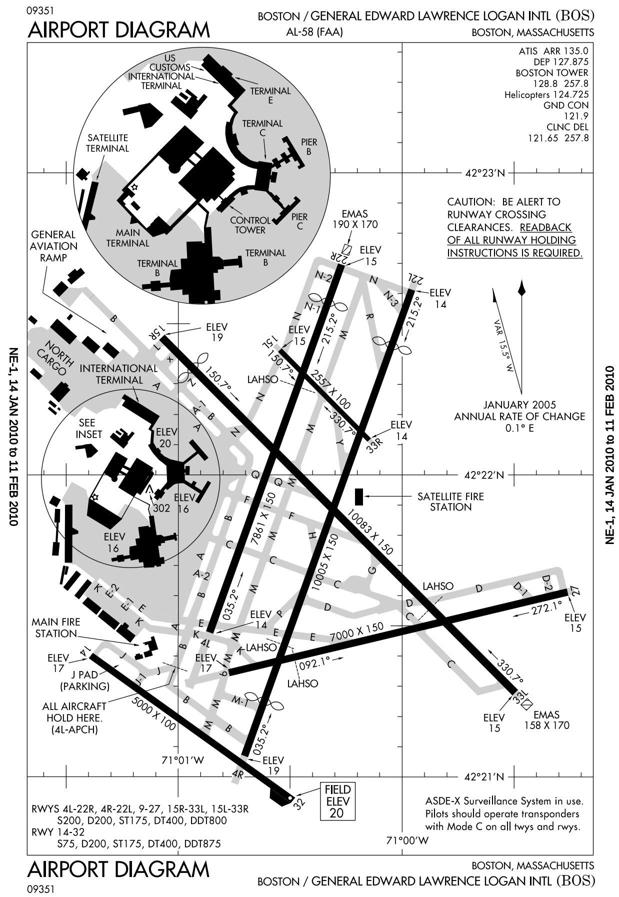

Figure 2: BOS airport diagram, showing alignment of runways.

duration of the demo, departures headed to 22R used 15L to cross runway 22R onto taxiway “Mike”. This resulted in active runway crossings in the 27, 22L | 22L, 22R configuration as well.

During our observations prior to the field tests as well as during the demo periods, we found that under Instrument Meteorological Conditions (IMC), arrivals into BOS are typically metered at the rate of 8 aircraft per 15 minutes by the TRACON. This results in a rather small departure demand, and there was rarely congestion under IMC at Boston during the evening departure push. For this reason, we focus on configurations most frequently used during VMC operations for the control policy design.

2.2 Fleet mix

Qualitative observations at BOS suggest that the departure throughput is significantly affected by the number of propeller-powered aircraft (props) in the departure fleet mix. In order to determine the effect of props, we analyze the tradeoff between takeoff and landing rates at BOS, parameterized by the number of props during periods of high departure demand.

Figure 3 shows that under Visual Meteorological Conditions (VMC), the number of props has a significant impact on the departure throughput, resulting in an increase at a rate of nearly one per 15 minutes for

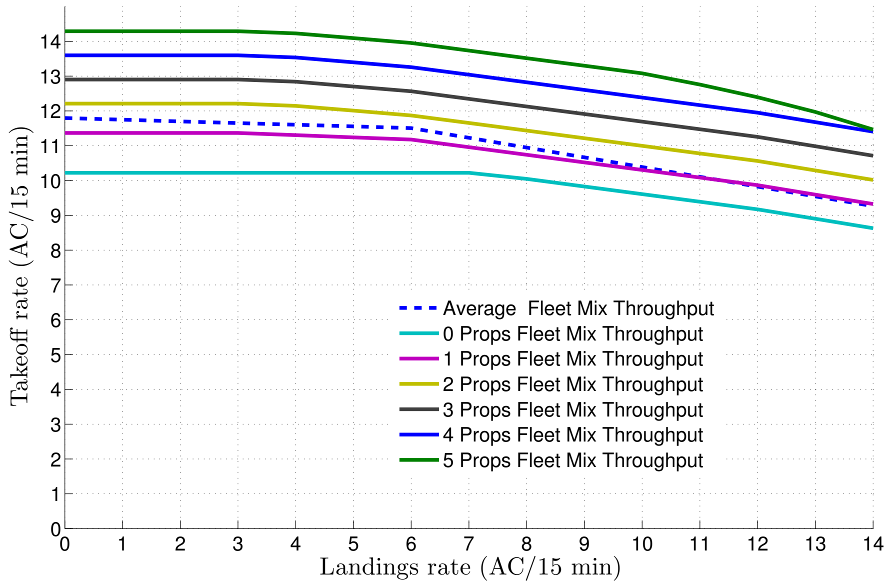

Figure 3: Regression of the takeoff rate as a function of the landing rate, parameterized by the number of props in a 15-minute interval for 22L, 27 | 22L, 22R configuration, under VMC [9].

each additional prop departure. This observation is consistent with procedures at BOS, since air traffic controllers fan out props in between jet departures, and therefore the departure of a prop does not interfere very much with jet departures. The main implication of this observation for the control strategy design at BOS was that props could be exempt from both the pushback control as well as the counts of aircraft taxiing out (N). Similar analysis also shows that heavy departures at BOS do not have a significant impact on departure throughput, in spite of the increased wake-vortex separation that is required behind heavy weight category aircraft. This can be explained by the observation that air traffic controllers at BOS use the high wake vortex separation requirement between a heavy and a subsequent departure to conduct runway crossings, thereby mitigating the adverse impact of heavy weight category departures [9].

Motivated by this finding, we can determine the dependence of the jet (i.e., non-prop) departure throughput as a function of the number of jet aircraft taxiing out, parameterized by the number of arrivals, as illustrated in Figure 4. This figure illustrates that during periods in which arrival demand is high, the jet departure throughput saturates when the number of jets taxiing out exceeds 17 (based on ASPM data).

2.3 Data sources

It is important to note that Figure 1, Figure 3 and Figure 4 are determined using ASPM data. Pushback times in ASPM are determined from the brake release times reported through the ACARS system, and are prone to error because about 40% of the flights departing from BOS do not automatically report these times [10]. Another potential source of pushback and takeoff times is the Airport Surface Detection Equipment Model X (or ASDE-X) system, which combines data from airport surface radars, multilateration sensors, ADS-B, and aircraft transponders [11]. While the ASDE-X data is likely to be more accurate than the ASPM data, it is still noisy, due to factors such as late transponder capture (the ASDE-X tracks only begin after the pilot has turned on the transponder, which may be before or after the actual pushback time), aborted takeoffs (which have multiple departure times recorded), flights cancelled after pushback, etc. A comparison of

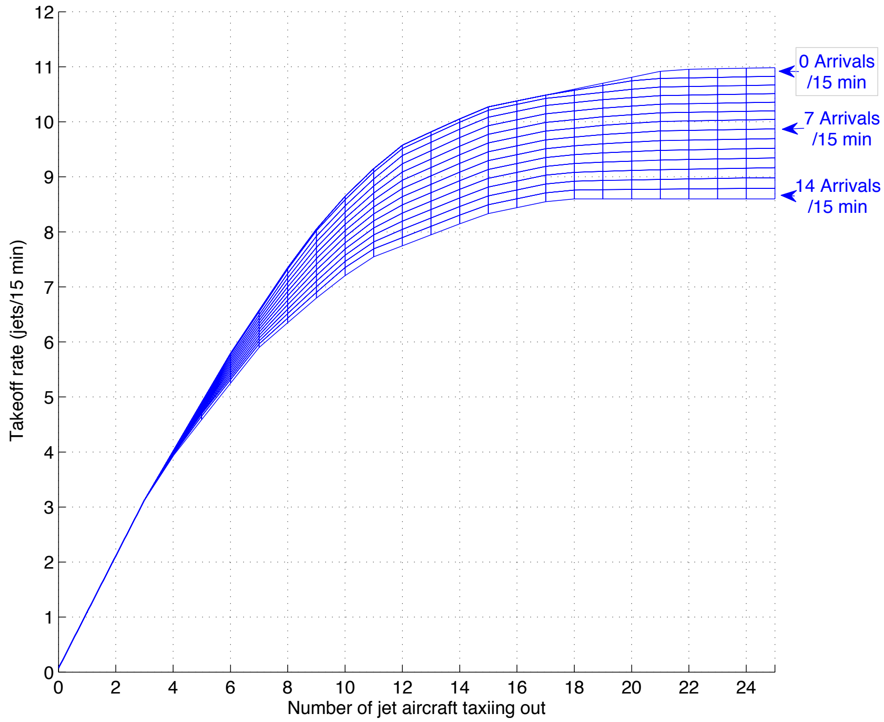

Figure 4: Regression of the jet takeoff rate as a function of the number of departing jets on the ground, parameterized by the number of arrivals for 22L, 27 | 22L, 22R configuration, under VMC [9].

both ASDE-X and ASPM records with live observations made in the tower on August 26, 2010 revealed that the average difference in the number of pushbacks per 15-minutes as recorded by ASDE-X and visual means is 0.42, while it is -3.25 for ASPM and visual observations, showing that the ASPM records differ considerably from ASDE-X and live observations. The above comparison motivates the recalibration of airport performance curves and parameters using ASDE-X data in addition to ASPM data. This is because ASPM data is not available in real-time and will therefore not be available for use in real-time deployments, and the ASDE-X data is in much closer agreement to the visual observations than ASPM.

We therefore conduct similar analysis to that shown in Figure 4, using ASDE-X data. The results are shown in Figure 5. We note that the qualitative behavior of the system is similar to what was seen with ASPM data, namely, the jet throughput of the departure runway initially increases because more jet aircraft are available in the departure queue, but as this number exceeds a threshold, the departure runway capacity becomes the limiting factor, and there is no additional increase in throughput. By statistically analyzing three months of ASDE-X data from Boston Logan airport using the methodology outlined in [9], we determine that the average number of active jet departures on the ground at which the surface saturates is 12 jet aircraft for the 22L, 27 | 22L, 22R configuration, during periods of moderate arrival demand. This value is close to that deduced from Figure 5, using visual means.

2.4 Estimates of N^*

Table 1 shows the values of N^* for the three main runway configurations under VMC, that were used during the field tests based on the ASDE-X data analysis. For each runway configuration, we use plots similar to Figure 5 to determine the expected throughput. For example, if the runway configuration is 22L, 27 | 22L,

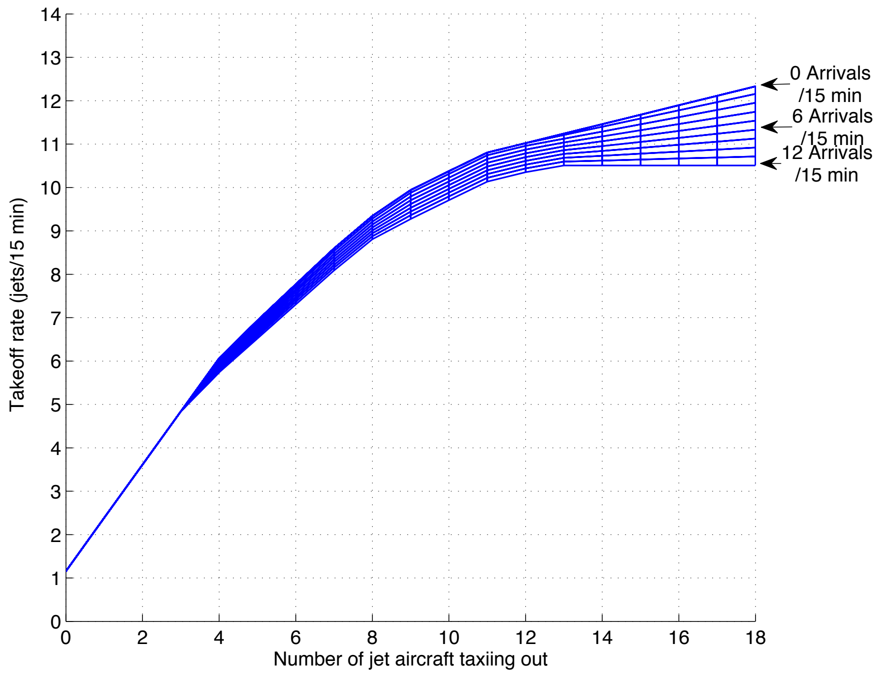

Figure 5: Regression of the takeoff rate as a function of the number of jets taxiing ~~out, para~~meterized by the number of arrivals, using ASDE-X data, for the 22L, 27 | 22L, 22R configuration.

22R, 11 jets are taxiing out, and the expected arrival rate is 9 aircraft in the next 15 minutes, the expected departure throughput is 10 aircraft in the next 15 minutes.

Table 1: Values of N^* estimated from the analysis of ASDE-X data.

Configuration	N^*
22L, 27 | 22L, 22R	12
27, 32 | 33L	12
4L, 4R | 4L, 4R, 9	15

3 Implementation of pushback rate control

The pushback rate was determined so as to keep the number of jets taxiing out near a suitable value (N_{ctrl}), where N_{ctrl} is greater than N^*, in order to mitigate risks such as under-utilizing the runway, facing many gate conflicts, or being unable to meet target departure times. Off-nominal events such as gate-use conflicts and target departure times were carefully monitored and addressed. Figure 6 shows a schematic of the decision process to determine the suggested pushback rate.

The determination of the pushback rate is conducted as follows. Prior to the start of each 15-minute period, we:

1. Observe the operating configuration, VMC/IMC, and the predicted number of arrivals in the next 15 minutes (from ETMS) and using these as inputs into the appropriate departure throughput saturation curves (such as Figure 5), determine the expected jet departure throughput.

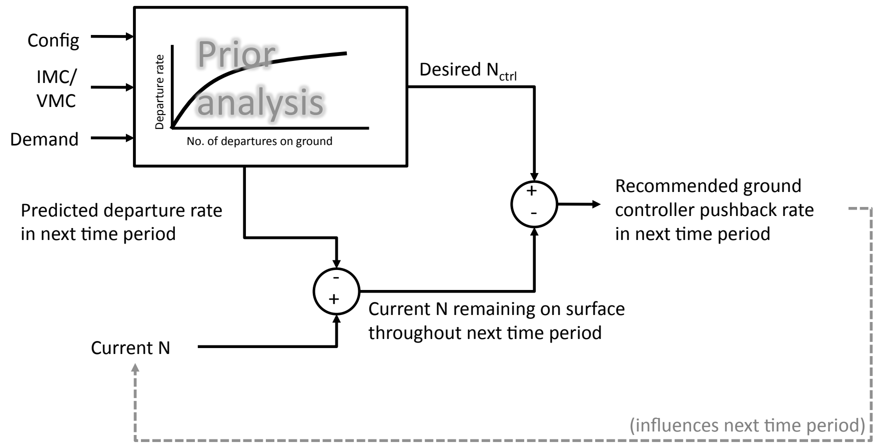

Figure 6: A schematic of the pushback rate calculation.

2. Using visual observations, count the number of departing jets currently active on the surface. We counted a departure as active once the pushback tug was attached to the aircraft and it was in the process of pushing back.

3. Calculate the difference between the current number of active jet departures and the expected jet departure throughput. This difference is the number of currently active jets that are expected to remain on the ground through the next 15 min.

4. The difference between N_{ctrl} and the result of the previous step provides us with the additional number of pushbacks to recommend in next 15 minutes.

5. Translate the suggested number of pushbacks in the next 15 minutes to an approximate pushback rate in a shorter time interval more appropriate for operational implementation (for example, 10 aircraft in the next 15 minutes would translate to a rate of “2 per 3 minutes.”).

3.1 Communication of recommended pushback rates and gate-hold times

During the demo, we used color-coded cards to communicate suggested pushback rates to the air traffic controllers, thereby eliminating the need for verbal communications. We used one of eight 5 in $\times$ 7.5 in cards, with pushback rate suggestions that ranged from “1 per 3 minutes” (5 in 15 minutes) to “1 aircraft per minute” (15 in 15 minutes), in addition to “Stop” (zero rate) and “No restriction” cards, as shown in Figure 7 (left). The setup of the suggested rate card in the Boston Gate controllers position is shown in Figure 7 (right).

The standard format of the gate-hold instruction communicated by the Boston Gate controller to the pilots included both the current time, the length of the gate-hold, and the time at which the pilot could expect to be cleared. For example:
Boston Gate: “AAL123, please hold push for 3 min. Time is now 2332, expect clearance at 2335. Remain on my frequency, I will contact you.”

In this manner, pilots were made aware of the expected gate-holds, and could inform the controller of constraints such as gate conflicts due to incoming aircraft. In addition, ground crews could be informed of the expected gate-hold time, so that they could be ready when push clearance was given. The post-analysis

Figure 7: (Left) Color-coded cards that were used to communicate the suggested pushback rates. (Right) Display of the color-coded card in the Boston Gate controller's position.

of the tapes of controller-pilot communications showed that the controllers cleared aircraft for push at the times they had initially stated (i.e., an aircraft told to expect to push at 2335 would be cleared at 2335), and that they also accurately implemented the push rates suggested by the cards.

3.2 Handling of off-nominal events

The implementation plan also called for careful monitoring of off-nominal events and system constraints. Of particular concern were gate conflicts (for example, an arriving aircraft is assigned a gate at which a departure is being held), and the ability to meet controlled departure times (Expected Departure Clearance Times or EDCTs) and other constraints from Traffic Management Initiatives. After discussions with the Tower and airlines prior to the field tests, the following decisions were made:

1. Flights with EDCTs would be handled as usual and released First-Come-First-Served. Long delays would continue to be absorbed in the standard holding areas. Flights with EDCTs did not count toward the count of active jets when they pushed back; they counted toward the 15-minute interval in which their departure time fell. An analysis of EDCTs from flight strips showed that the ability to meet the EDCTs was not impacted during the field tests.

2. Pushbacks would be expedited to allow arrivals to use the gate if needed. Simulations conducted prior to the field tests predicted that gate-conflicts would be relatively infrequent at BOS; there were only two reported cases of potential gate-conflicts during the field tests, and in both cases, the departures were immediately released from the gate-hold and allowed to pushback.

3.3 Determination of the time period for the field trials

The pushback rate control protocol was tested in select evening departure push periods (4-8PM) at BOS between August 23 and September 24, 2010. Figure 8 shows the average number of departures on the ground in each 15-minute interval using ASPM data. There are two main departure pushes each day. The evening departure push differs from the morning one because of the larger arrival demand in the evenings.

The morning departure push presents different challenges, such as a large number of flights with controlled departure times, and a large number of tow-ins for the first flights of the day.

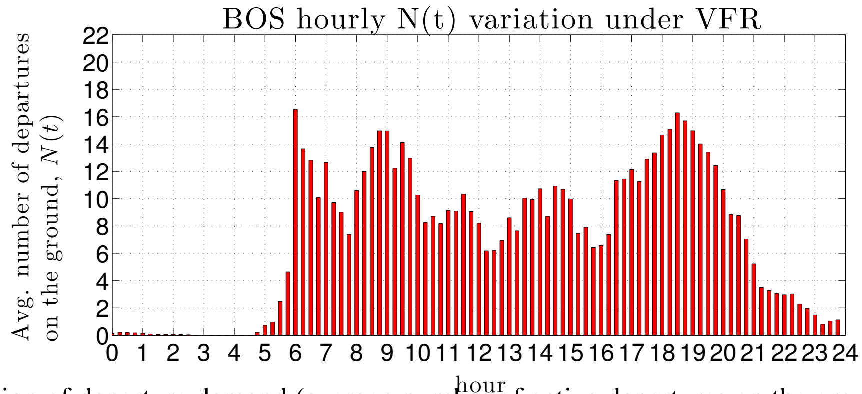

Figure 8: Variation of departure demand (average number of active departures on the ground) as a function of the time of day.

4 Results of field tests

Although the pushback rate control strategy was tested at BOS during 16 demo periods, there was very little metering when the airport operated in its most efficient configuration (4L, 4R | 4L, 4R, 9), and in only eight of the demo periods was there enough congestion for gate-holds to be experienced. There was insufficient congestion for recommending restricted pushback rates on August 23, September 16, 19, 23, and 24. In addition, on September 3 and 12, there were no gate-holds (although departure demand was high, traffic did not build up, and no aircraft needed to be held at the gate). For the same reason, only one aircraft received a gate-hold of 2 min on September 17. The airport operated in the 4L, 4R | 4L, 4R, 9 configuration on all three of these days. In total, metering was in effect during the field tests for over 37 hours, with about 24 hours of test periods with significant gate-holds.

4.1 Data analysis examples

In this section, we examine three days with significant gate-holds (August 26, September 2 and 10) in order to describe the basic features of the pushback rate control strategy.

Figure 9 shows taxi-out times from one of the test periods, September 2. Each green bar in Figure 9 represents the actual taxi-out time of a flight (measured using ASDE-X as the duration between the time when the transponder was turned on and the wheels-off time). The red bar represents the gate-hold time of the flight (shown as a negative number). In practice, there is a delay between the time the tug pushes them from the gate and the time their transponder is turned on, but statistical analysis showed that this delay was random, similar distributed for flights with and without gate-holds, and typically about 4 minutes. We note in Figure 9 that as flights start incurring gate-holds (corresponding to flights departing at around 1900 hours), there is a corresponding decrease in the active taxi-out times, i.e., the green lines. Visually, we notice that as the length of the gate-hold (red bar) increases, the length of the taxi-out time (green bar) proportionately decreases. There are still a few flights with large taxi-out times, but these typically correspond to flights with EDCTs. These delays were handled as in normal operations (i.e., their gate-hold times were not increased),

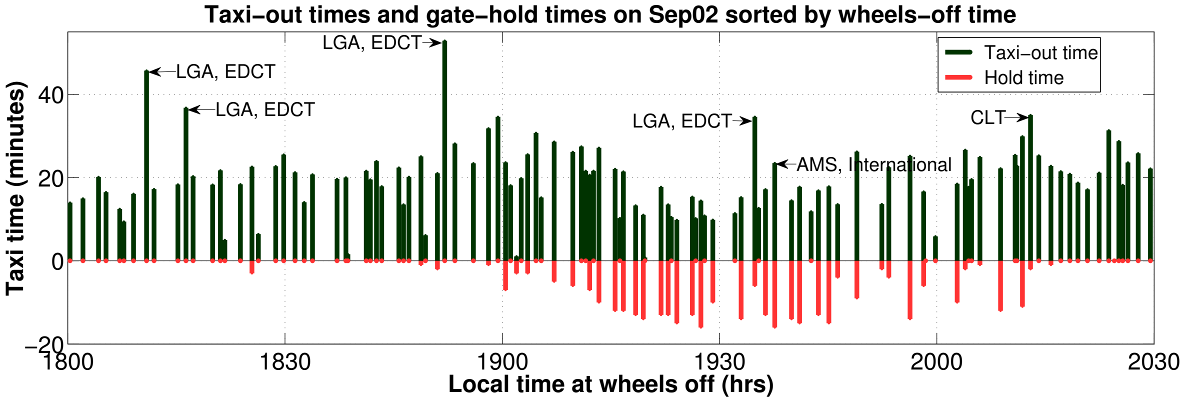

Figure 9: Taxi-out and gate-hold times from the field test on September 2, 2010.

as was agreed with the tower and airlines. Finally, there are also a few flights with no gate-holds and very short taxi-out times, typically corresponding to props.

The impact of the metering can be further visualized by using ASDE-X data, as can be seen in the Figure 10, which shows snapshots of the airport surface at two instants of time, the first before the metering started, and the second during the metering. We notice the significant decrease in taxiway congestion, in particular the long line of aircraft between the ramp area and the departure runway, due to the activation of the pushback rate control strategy.

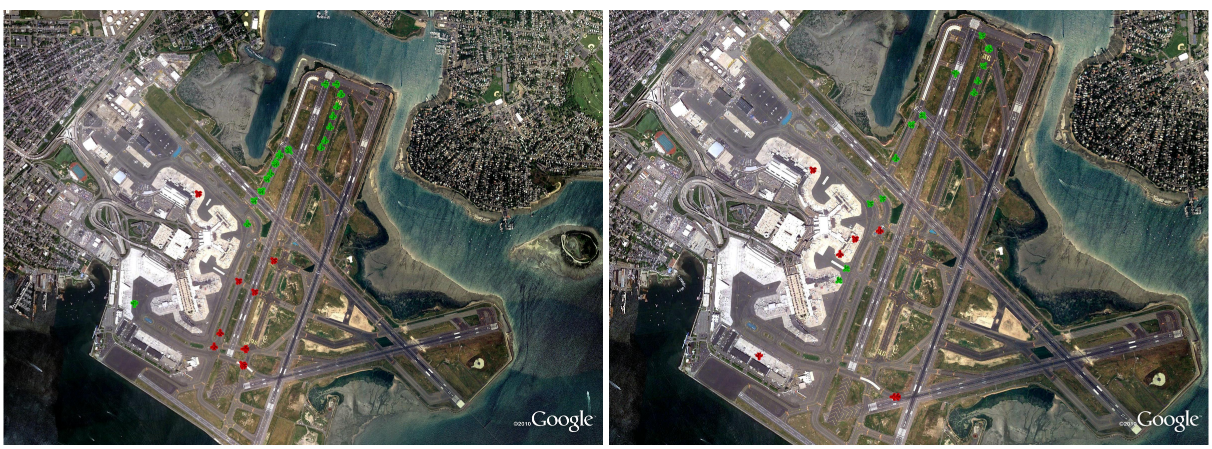

Figure 10: Snapshots of the airport surface, (left) before metering, and (right) during metering of pushbacks. Departing aircraft are shown in green, and arrivals in red. We note that the line of 15 departures between the ramp area and the departure runway prior to commencement of pushback rate control reduces to 8 departures during metering. The white area on the taxiway near the top of the images indicates the closed portion of taxiway “November”.

Looking at another day of trials with a different runway configuration, Figure 11 shows taxi-out times from the test period of September 10. In this plot, the flights are sorted by pushback time. We note that as flights start incurring gate-holds, their taxi time stabilizes at around 20 minutes. This is especially evident during the primary departure push between 1830 and 1930 hours. The gate-hold times fluctuate from 1-2 minutes up to 9 minutes, but the taxi-times stabilize as the number of aircraft on the ground stabilizes to the

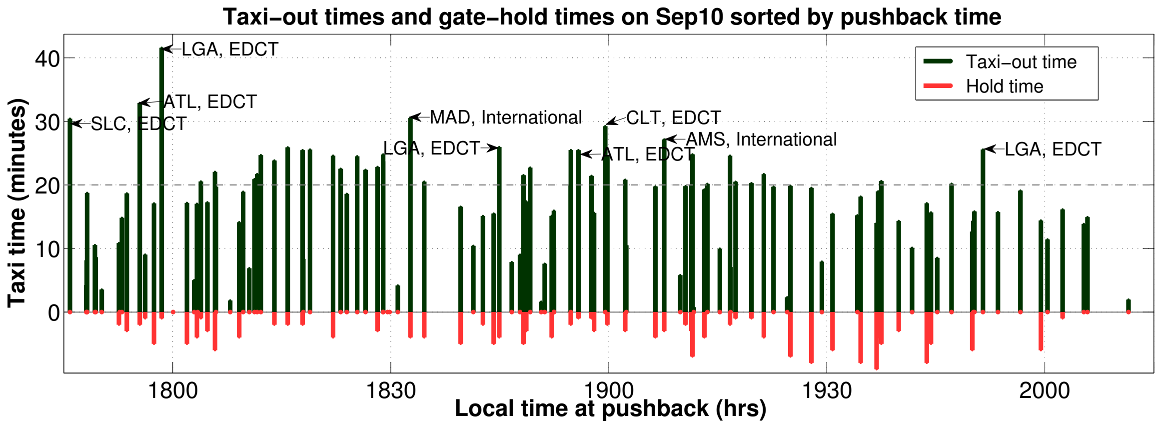

Figure 11: Taxi-out and gate-hold times from the field test on September 10, 2010.

specified N_{ctrl} value. Finally, the flights that pushback between 1930 and 2000 hours are at the end of the departure push and derive the most benefit from the metering strategy: they have longer gate holds, waiting for the queue to drain and then taxi to the runway facing a gradually diminishing queue.

Figure 12 further illustrates the benefits of the pushback rate control protocol, by comparing operations from a day with pushback rate control (shown in blue) and a day without (shown in red), under similar demand and configuration. The upper plot shows the average number of jets taxiing-out, and the lower plot the corresponding average taxi-out time, per 15-minute interval. We note that after 1815 hours on September 10, the number of jets taxiing out stabilized at around 15. As a result, the taxi-out times stabilized at about 16 minutes. Pushback rate control smooths the rate of the pushbacks so as to bring the airport state to the specified state, N_{ctrl}, in a controlled manner. Both features of pushback rate control, namely, smoothing of demand and prevention of congestion can be observed by comparing the evenings of September 10 and September 15. We see that on September 15, in the absence of pushback rate control, as traffic started accumulating at 1745 hours, the average taxi-out time grew to over 20 minutes. During the main departure push (1830 to 1930), the average number of jets taxiing out stayed close to 20 and the average taxi-out time was about 25 minutes.

Similarly, Figure 13 compares the results of a characteristic pushback rate control day in runway configuration 27, 22L | 22L, 22R, August 26, to a similar day without pushback metering. We observe that for on August 26, the number of jets taxiing out during the departure push between 1830 and 1930 hours stabilized at 15 with an average taxi-out time of about 20 minutes. On August 17, when metering was not in effect, the number of aircraft reached 20 at the peak of the push and the average taxi-out times were higher than those of August 26.

4.2 Runway utilization

The overall objective of the field test was to maintain pressure on the departure runways, while limiting surface congestion. By maintaining runway utilization, it is reasonable to expect that gate-hold times translate to taxi-out time reduction, as suggested by Figure 9. We therefore also carefully analyze runway utilization (top) and departure queue sizes (bottom) during metering periods, as illustrated in Figure 14.

In estimating the runway utilization, we determine (using ASDE-X data) what percentage of each 15-min interval corresponded to a departure on takeoff roll, to aircraft crossing the runway, arrivals (that requested landing on the departure runway) on final approach, departure that is holding for takeoff clearance, etc. We

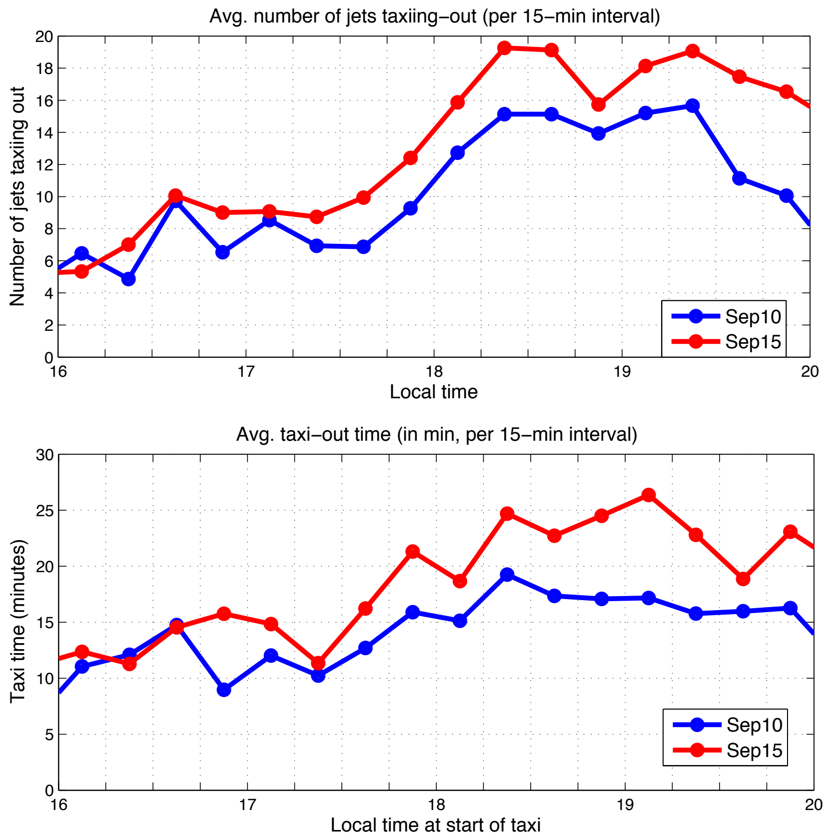

Figure 12: Surface congestion (top) and average taxi-out times (bottom) per 15-minutes, for (blue) a day with pushback rate control, and (red) a day with similar demand, same runway configuration and visual weather conditions, but without metering. Delay attributed to EDCTs has been removed from the taxi-out time averages.

note that between 1745 and 2000 hours, when gate-holds were experienced, the runway utilization was kept at or close to 100%, with a persistent departure queue as well.

Runway utilization was maintained consistently during the metering periods, with the exception of a three-minute interval on the third day of metering. On this instance, three flights were expected to be at the departure runway, ready for takeoff. Two of these flights received EDCTs as they taxied (and so were not able to takeoff at the originally predicted time), and the third flight was an international departure that had longer than expected pre-taxi procedures. Learning from this experience, we were diligent in ensuring that EDCTs were gathered as soon as they were available, preferably while the aircraft were still at the gate. In addition, we incorporated the longer taxi-out times of international departures into our predictions. As a result of these measures, we ensured that runway utilization was maintained over the remaining duration of the trial. It is worth noting that the runway was "starved" in this manner for only 3 minutes in over 37 hours of metering pushbacks, demonstrating the ability of the approach to adapt to the uncertainties in the system.

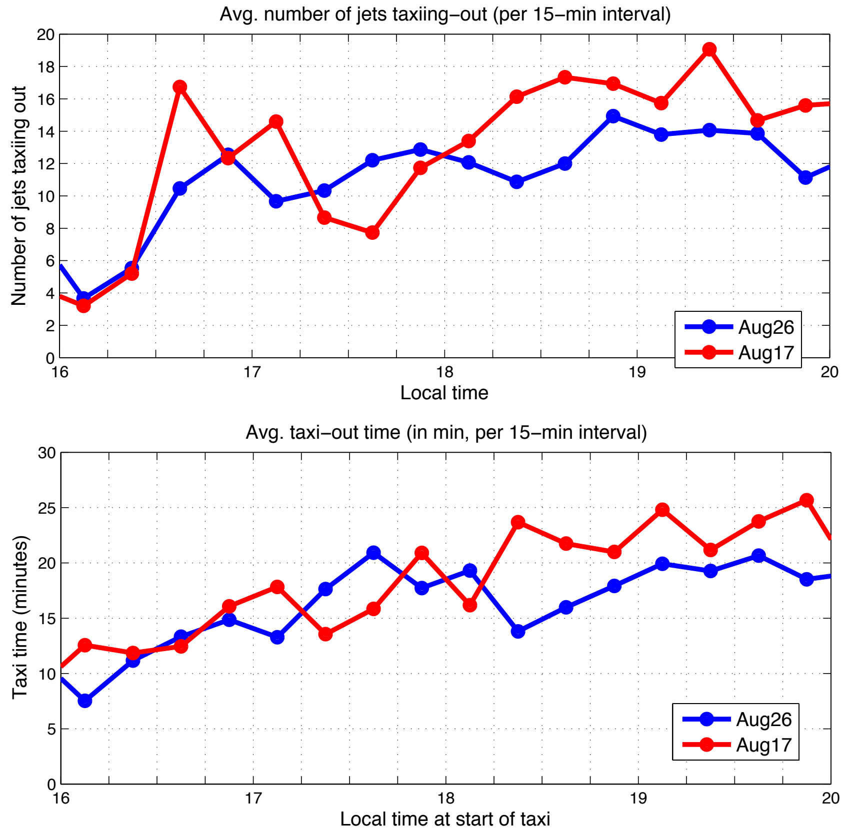

Figure 13: Ground congestion (top) and average taxi-out times (bottom) per 15-minutes, for (blue) a day with pushback rate control, and (red) a day with similar demand, same runway configuration and weather conditions, but without metering. Delay attributed to EDCTs has been removed from the taxi-out time averages.

5 Benefits analysis

Table 2 presents a summary of the gate-holds on the eight demo periods with sufficient congestion for metering pushbacks. As mentioned earlier, we had no significant congestion when the airport was operating in its most efficient configuration (4L, 4R | 4L, 4R, 9).

A total of 247 flights were held, with an average gate-hold of 4.3 min. During the most congested periods, up to 44% of flights experienced gate-holds. By maintaining runway utilization, we tradeoff taxi-out time for time spent at the gate with engines off, as illustrated in Figures 9 and 11.

5.1 Translating gate-hold times to taxi-out time reduction

Intuitively, it is reasonable to use the gate-hold times as a surrogate for the taxi-out time reduction, since runway utilization was maintained during the demonstration of the control strategy. We confirm this hypothesis through a simple "what-if" simulation of operations with and without metering. The simulation shows that the total taxi-out time savings equaled the total gate-hold time, and that the taxi time saving of each flight was equal, in expectation, to its gate holding time. The total taxi-out time reduction can therefore be

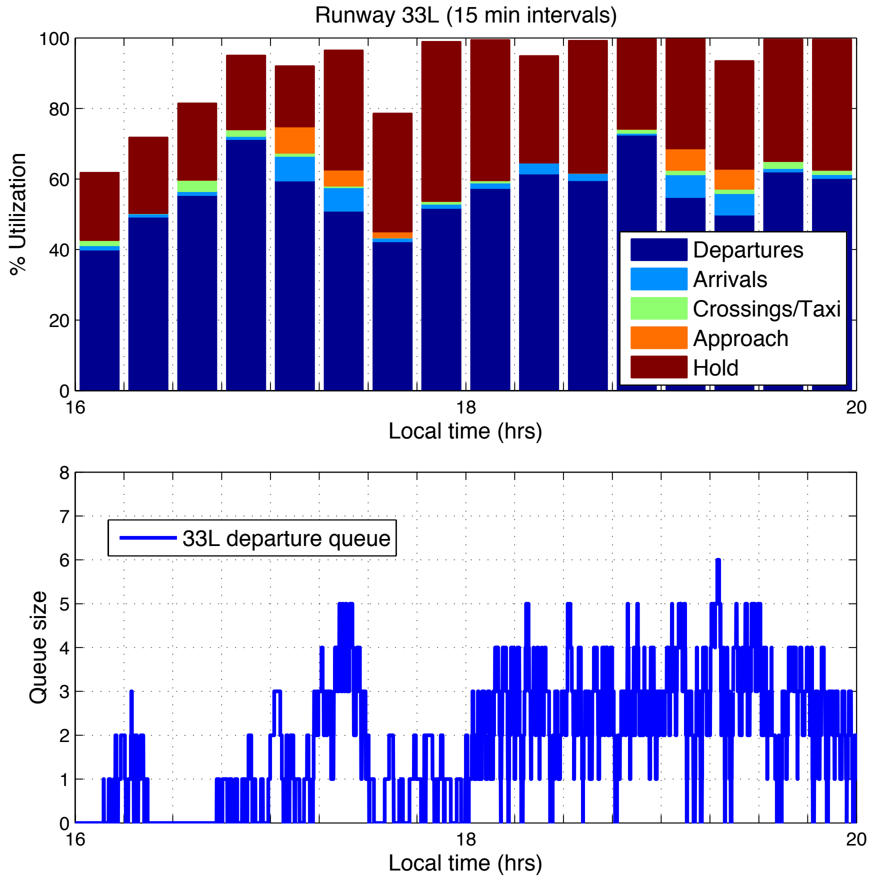

Figure 14: Runway utilization plots (top) and queue sizes (bottom) for the primary departure runway (33L) during the field test on September 10, 2010. These metrics are evaluated through the analysis of ASDE-X data.

approximated by the total gate-hold time, or 1077 minutes (18 hours).

In reality, there are also second-order benefits due to the faster travel times and the nonlinear effects of shorter departure queues due to reduced congestion, but these effects are neglected in the preliminary analysis.

5.2 Fuel burn savings

Supported by the analysis presented in Section 5.1, we conduct a preliminary benefits analysis of the field tests by using the gate-hold times as a first-order estimate of taxi-out time savings. This assumption is also supported by the taxi-out time data from the tests, such as the plot shown in Figure 9. Using the tail number of the gate-held flights, we determine the aircraft and engine type and hence its ICAO taxi fuel burn index [12]. The multiplicative product of the fuel burn rate index, the number of engines, and the gate-hold time gives us an estimate of the fuel burn savings from the metering. We can also account for the use of Auxiliary Power Units (APUs) at the gate by using the appropriate fuel burn rates [13]. This analysis (not accounting for benefits from reduced congestion) indicates that the total taxi-time savings were about 17.9 hours, which resulted in fuel savings of 12,000-15,000 kg, or 3,900-4,900 US gallons (depending on whether APUs were

Table 2: Summary of gatehold times for the eight demo periods with significant metering and gate-holds.

	Date	Period	Configuration	No. of gate-holds	Average gatehold (min)	Total gatehold (min)
1	8/26	4.45-8PM	27,22L | 22L,22R	63	4.06	256
2	8/29	4.45-8PM	27,32 | 33L	34	3.24	110
3	8/30	5-8PM	27,32 | 33L	8	4.75	38
4	9/02	4.45-8PM	27,22L | 22L,22R	45	8.33	375
5	9/06	5-8PM	27,22L | 22L,22R	19	2.21	42
6	9/07	5-7.45PM	27,22L | 22L,22R	11	2.09	23
7	9/09	5-8PM	27,32 | 33L	11	2.18	24
8	9/10	5-8PM	27,32 | 33L	56	3.7	207
Total				247	4.35	1075

on or off at the gate). This translates to average fuel savings per gate-held flight of between 50-60 kg or 16-20 US gallons, which suggests that there are significant benefits to be gained from implementing control strategies during periods of congestion. It is worth noting that the per-flight benefits of the pushback rate control strategy are of the same order-of-magnitude as those of Continuous Descent Approaches in the presence of congestion [14], but do not require the same degree of automation, or modifications to arrival procedures.

5.3 Fairness of the pushback rate control strategy

Equity is an important factor in evaluating potential congestion management or metering strategies. The pushback rate control approach, as implemented in these field tests, invoked a First-Come-First-Serve policy in clearing flights for pushback. As such, we would expect that there would be no bias toward any airline with regard to gate-holds incurred, and that the number of flights of a particular airline that were held would be commensurate with the contribution of that airline to the total departure traffic during metering periods. We confirm this hypothesis through a comparison of gate-hold share and total departure traffic share for different airlines, as shown in Figure 15. Each data-point in the figure corresponds to one airline, and we note that all the points lie close to the 45-degree line, thereby showing no bias toward any particular airline.

We note, however, that while the number of gate-holds that an airline receives is proportional to the number of its flights, the actual fuel burn benefit also depends on its fleet mix. Figure 16 shows that while the taxi-out time reductions are similar to the gate-holds, some airlines (for example, Airlines 3, 4, 5, 19 and 20) benefit from a greater proportion of fuel savings. These airlines are typically ones with several heavy jet departures during the evening push.

6 Observations and lessons learned

We learned many important lessons from the field tests of the pushback rate control strategy at BOS, and also confirmed several hypotheses through the analysis of surveillance data and qualitative observations. Firstly, as one would expect, the proposed control approach is an aggregate one, and requires a minimum level of traffic to be effective. This hypothesis is further borne by the observation that there was very little metering in the most efficient configuration (4L, 4R | 4L, 4R, 9). The field tests also showed that the proposed technique is capable of handling target departure times (e.g., EDCTs), but that it is preferable to get EDCTs while still at gate. While many factors drive airport throughput, the field tests showed that the pushback rate control

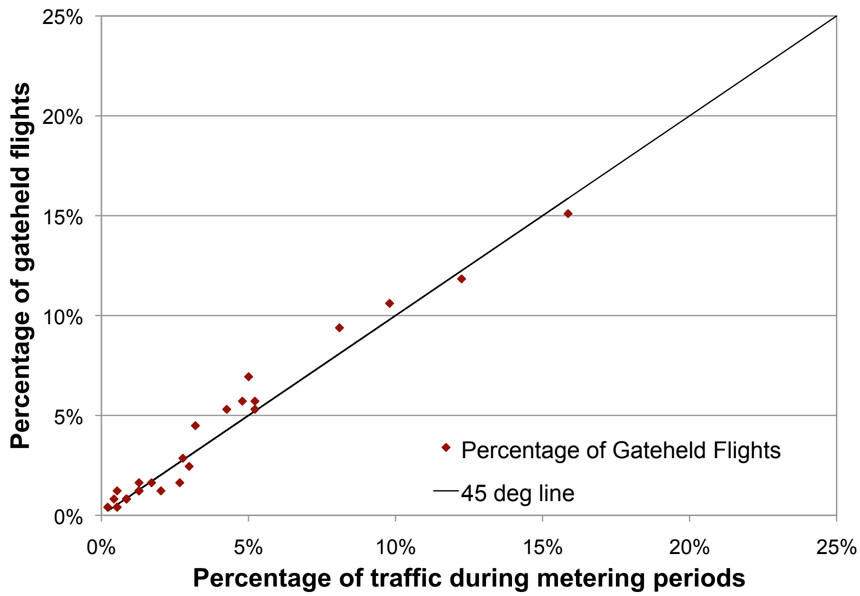

Figure 15: Comparison of gate-hold share and total departure traffic share for different airlines.

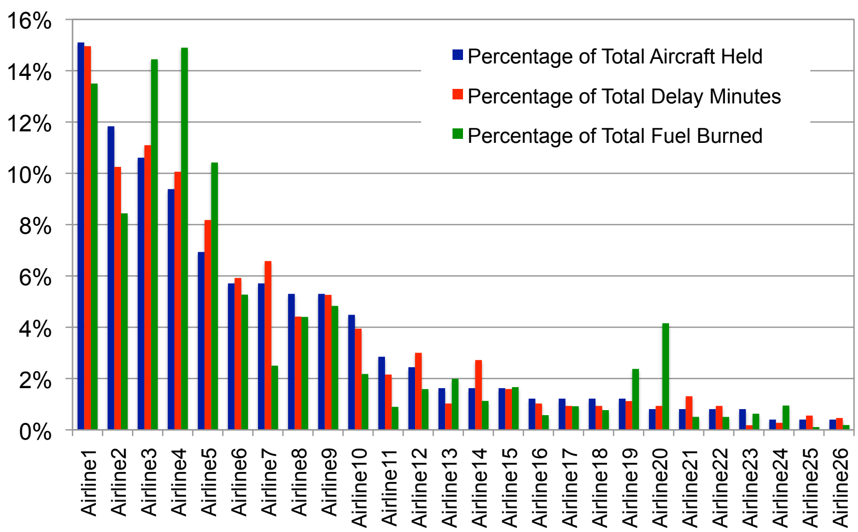

Figure 16: Percentage of gate-held flights, taxi-out time reduction and fuel burn savings incurred by each airline.

approach could adapt to variability. In particular, the approach was robust to several perturbations to runway throughput, caused by heavy weight category landings on departure runway, controllers choice of runway crossing strategies, birds on runway, etc. We also observed that when presented with a suggested pushback rate, controllers had different strategies to implement the suggested rate. For example, for a suggested rate of 2 aircraft per 3 minutes, some controllers would release a flight every 1.5 minutes, while others would release two flights in quick succession every three minutes. We also noted the need to consider factors such

as ground crew constraints, gate-use conflicts, and different taxi procedures for international flights. By accounting for these factors, the pushback rate control approach was shown to have significant benefits in terms of taxi-out times and fuel burn.

7 Summary

This paper presented the results of the demonstration of a pushback rate control strategy at Boston Logan International Airport. Sixteen demonstration periods between August 23 and September 24, 2010 were conducted in the initial field trial phase, resulting in over 37 hours of research time in the BOS tower. Results show that during eight demonstration periods (about 24 hours) of active metering of pushback rates, over 1077 minutes (nearly 18 hours) of gate holds were experienced during the demonstration period across 247 flights, at an average of 4.3 minutes of gate hold per flight (which correlated well to the observed decreases in taxi-out time). Preliminary fuel burn savings from gate-holds with engines off were estimated to be between 12,000-15,000 kg (depending on whether APUs were on or off at the gate).

Acknowledgments

We would like to acknowledge the cooperation and support of the following individuals who made the demo at BOS possible: Deborah James, Pat Hennessy, John Ingaharro, John Melecio, Michael Nelson and Chris Quigley at the BOS Facility; Vincent Cardillo, Flavio Leo and Robert Lynch at Massport; and George Ingram and other airline representatives at the ATA. Alex Nakahara provided assistance in computing the preliminary fuel burn savings from the gate-hold data, and Regina Clewlow, Alex Donaldson and Diana Michalek Pfeil helped with tower observations before and during the trials. We are also grateful to Lourdes Maurice (FAA) and Ian Waitz (MIT) for insightful feedback on the research, and James Kuchar, Jim Eggert and Daniel Herring of MIT Lincoln Laboratory for their support and help with the ASDE-X data.

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Reduced/Single Engine Taxiing at Logan Airport Memorandum

This Appendix provides detailed information in support of *Chapter 7, Air Quality/ Emissions Reduction:*

- Memorandum from Edward C. Freni, Massport Director of Aviation, to the Boston Logan Airline Committee, Regarding Single/Reduced Engine Taxiing at Boston Logan, Dated January 4, 2011
- Clewlow, Regina, Hamsa Balakrishnan, and Tom Reynolds. "A Survey of Airline Pilots Regarding Fuel Conservation Procedures for Taxi Operations." *International Airport Review.* Issue 3, 2010.

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Massachusetts Port Authority
One Harborside Drive
East Boston, MA 02128-2909
Telephone (617) 568-5000
www.massport.com

To: Boston Logan Airline Committee (BAC)

From: Edward C. Freni
Director of Aviation

Date: January 4, 2011

RE: Single/Reduced Engine Taxiing at Boston Logan

As an important user of Boston-Logan International Airport ("Boston Logan"), your involvement in making Boston Logan the safest, most dependable and environmentally friendly airport is critical to us. Working together we have successfully implemented cutting edge safety technology including the Runway Status Lights and the ASDE-X radar and constructed new airside facilities including Runway 14/32, Taxiway Mike and other taxiway modifications. Our ability to implement these improvements at Logan is based in part on continuing to work on measures that minimize environmental impacts from various landside and airside operations.

One such important operational measure that has been identified is single/reduced engine taxiing. Based on previous outreach to the air carrier community serving Boston Logan, it is clear to Massport that single or reduced engine taxiing is being utilized when deemed appropriate by the pilot. While fuel savings is a significant benefit and the primary motivation for air carriers, reducing aircraft emissions is also an important additional benefit and the primary environmental goal for encouraging single engine taxiing. It is our hope that the current level of implementation will continue or be expanded consistent with your safety procedures and subject to pilot discretion and operational conditions.

To better understand how single/reduced engine taxiing is being used at Boston Logan and inform the pilot community, the Massachusetts Institute of Technology undertook a survey of pilots at Boston Logan. The survey, funded by the FAA and supported by Massport, has provided important insight on how single engine taxiing is applied in general and at Boston Logan in particular. The major findings of the survey are:

- Single engine taxiing is "quite prevalent in current operations".
- 95% responded that fuel conservation was important
- 70% of the respondents indicated that their airlines encourage the use of single engine taxiing
- Single engine taxiing is used more on arrivals than departures

- Boston Logan's Runways 33L and 27R are the top departure runways where single engine taxiing is used to get to the runway end. Runways 9 and 15R are the top departure runways where single engine taxiing is not used to get to the runway end (due to short taxiing distances)
- Identified operational practices to reduce taxi-out fuel burn included:
  - shutting down all engines during long delays,
  - shutting down or controlling the use of APUs,
  - minimizing thrust and controlling speed on taxiways
  - Delaying engine start until engine use is necessary.

Key reasons why single engine taxiing might not be used are primarily related to safety (e.g., bad weather, need for pilot to keep "heads up") or operational needs (e.g., anticipated short taxi time) or engine warm up/warm down requirements. For more detail findings of the survey enclosed please find a copy of an article published earlier this year in International Airport Review highlighting the survey.

I encourage you to share these findings and the attached article with your flight crews and want to thank you for the continued use of single or reduced engine taxiing procedures at Logan, subject, of course, to pilot judgment, engine performance considerations, operational conditions and, above all, safety. In the meantime if you have any questions or would like to discuss any aspect of this letter/survey, please feel free to contact me or Mr. Flavio Leo at 617-568-3528 at your earliest convenience.

A Survey of Airline Pilots Regarding Fuel Conservation Procedures for Taxi Operations

By Regina Clewlow, Hamsa Balakrishnan, Tom Reynolds, and R. John Hansman
Massachusetts Institute of Technology, Cambridge, MA 02139, USA

Aircraft taxi operations are a significant source of energy consumption and emissions at airports. In 2007, an estimated 4,000 tons of hydrocarbons, 8,000 tons of nitrogen oxides and 45,000 tons of carbon monoxide were emitted through taxi-out operations at U.S. airports[1]. These pollutants contribute to low-altitude emissions, directly impact local nonattainment of air pollution standards, and represent an endangerment to human health and welfare.

Given increasing fuel prices and concern about aviation-related environmental impacts, airlines have implemented a number of practices to reduce fuel burn during ground operations. Such strategies include minimizing use of the auxiliary power unit, controlling speed on the taxiway system, and reducing surface congestion and delays by holding aircraft at the gate. Researchers from the Massachusetts Institute of Technology's International Center for Air Transportation and the Partnership for AiR Transportation Noise and Emission Reduction conducted a survey of airline pilots at Boston Logan International Airport to assess their attitudes towards fuel conservation during taxi operations, and to document current fuel conservation practices, particularly single-engine taxi procedures.

This study found that the majority of pilots believe that fuel conservation is important; their motivation to conserve fuel is mainly driven by concerns about their airlines' economic viability, as well as the environmental impacts of aviation. The study also found that single-engine taxiing is quite prevalent in current operations, especially arrivals, and identified some of the practical challenges surrounding such procedures.

Survey of Pilots at BOS

With the cooperation of the Massachusetts Port Authority, MIT researchers conducted a web- and paper-based survey of pilots at BOS between August and December 2009. Links to the web survey were sent via e-mail to station managers and chief pilots for all airlines at BOS. Print copies, along with prepaid return envelopes and a drop-off folder, were also placed in the crew lounges. Participation in the survey was voluntary and the responses were anonymous. Sixty-four survey responses were received, representing most major carriers and one low-cost carrier; however, there was significant representation from 2-3 airlines. Forty-three of the respondents were captains, and 19 were first officers. Thirteen pilots indicated that BOS was their base airport. Half the pilots flew through BOS an average of 5.4 times a week, while the other half only flew through BOS an average of seven times per year. (The overall average was 2.8 times per month.) The average flight experience among the respondents was 22 years, with an average of eight years on their current aircraft.

Because the survey was conducted using a convenience sample, there is potential bias in the survey results: for example, those who are more concerned with fuel conservation are potentially more

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[1] H. Balakrishnan, I. Deonandan, and I. Simaiakis. Opportunities for reducing surface emissions through airport surface movement optimization. Technical report, Massachusetts Institute of Technology, 2008. Technical report Number ICAT-2008-7.

likely to have completed our survey. Nevertheless, the survey yielded useful responses regarding current fuel saving practices, as well as pilots' experiences using single-engine taxi procedures.

General Attitudes towards Fuel Conservation

More than 95% of pilots responding to the survey indicated that fuel conservation is important to them, with 80% indicating that it is very important, and 16% indicating that it is somewhat important. These results are higher than recent studies on conservation and the environment, including studies by the Pew Center on Global Climate Change, Yale University, and George Mason University, which find that Americans' support for conservation ranges from 55% to 80%. However, as mentioned, our results may be biased as a result of our survey method.

Pilots indicated that motivating factors for fuel conservation included general economic and financial concerns, concerns about their airline's profitability, and concerns about the environment and emissions. With fuel accounting for a significant portion of airline operating costs, it is understandable that pilots' interests in fuel conservation are largely driven by economic concerns.

Taxi-out Fuel Burn Estimates

Pilots were asked to estimate the average taxi-out time at their base airports, what they would consider an excessive taxi-out time, and the estimated fuel burn (assuming that all the engines were being used). The results are shown in Table 1. Also included in the table are the average taxi-out times for 2009, as reported by the Aviation System Performance Metrics database.

Based on the survey results, pilots estimated an average (normal) taxi time to be roughly 20 minutes, and excessive taxi times ranged between approximately 30 and 90 minutes. The *additional fuel burn* due to excessive taxi-out times, as estimated by pilots, ranged between 225 and 500 kg per flight, depending on the airport. Applying information on the types of aircraft flown by survey respondents (combining data from the JP Airline Fleet Database and ICAO Engine Emissions Databank[2]), the taxi-out fuel burn for this survey group was estimated to be about 550 kg per flight.

Table 1. Pilots' Estimates of Taxi-out Times and Fuel Burn by Airport

Base Airport	Count	Average taxi-out time from ASPM (min)	Normal taxi-out times, pilot estimates (min)	Taxi-out fuel burn, pilot estimates (kg)	Excessive taxi-out times, pilot opinions (min)
All	59	N/A	20.1	225	41.7
ATL	8	21.8	20.3	252.5	39.4
BOS	9	18.3	13.7	278.6	30.6
EWR	2	25.7	25.0	317.5	67.5
JFK	8	31.1	38.8	437.4	93.1
LGA	2	24.4	32.5	340.2	82.5
LHR	16	N/A	19.5	764.0	32.2

[2] Bucher and Company, JP Airline Fleets International (2006/2007), 2006; ICAO Engine Emissions Databank, Issue 15, 2008.

Operational Practices to Reduce Taxi-out Fuel Burn

Pilots were asked which fuel conservation strategies were encouraged by their airlines during taxi operations, besides single-engine taxi procedures (which were assessed in more depth in the survey). The most common strategies cited were:

- shutting down all engines during long delays
- shutting down, or controlling use of, apus
- minimizing thrust and controlling speed on taxiways
- delaying engine start until engine use is necessary.

Pilots from international carriers noted that at most non-U.S. airports, delays are absorbed at the gate (instead of on the taxiway system), and that they often shut down all engines during gate holds. The majority of both U.S. and international pilots indicated that they shut down all engines during long delays, either at the gate or in airport holding-areas. For example, at Boston Logan Airport, the local air traffic controllers often hold aircraft on certain taxiways depending on the runway configuration being used.

Single-Engine Taxi Procedures

One potential strategy to reduce aircraft surface emissions is the use of single-engine taxi operations; that is, when a single engine is shut down/left off during taxiing on a twin-engine aircraft, or one to two engines are shut down/ left off on a four-engine aircraft. Prior research has indicated that single-engine taxiing can reduce surface emissions by up to 50%[3], although the savings may be lower because of the need to have higher thrust from the engine that is being used, and the fuel needed for cross-bleed starts. The survey respondents thought that single-engine taxiing would result in a 37% reduction in fuel burn, on average.

A majority of survey respondents (70%) indicated that their airlines encourage them to use single-engine taxi procedures, with 40% indicating that they are strongly encouraged to use them, and 31% indicating that they are encouraged. When asked further about the frequency of single-engine taxi use, it was found that these procedures were widely used on arrivals (52% of pilots reported using them more than 75% of the time), while they were infrequently used on departures (54% of pilots reported using them less than 10% of the time).

Operational Challenges Associated with Single-Engine Taxiing

Although single-engine taxiing may appear to be a simple and effective method to reduce fuel burn during surface operations, there are a number of perceived problems associated with the procedure. The four main challenges identified by respondents were:

- excessive thrust and associated issues
- maneuverability problems, particularly related to tight taxiway turns and weather
- problems starting the second engine
- distractions and workload issues

Given that there are maneuverability concerns associated with single-engine taxi procedures, we asked pilots if there are certain conditions under which single-engine taxi procedures were not used. As expected, many pilots indicated that they would not use single-engine taxi procedures with low visibility or tight taxiway turns (due to problems turning into the operating engine). However,

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[3] V. Kumar, L. Sherry, and T. Thompson, "Analysis of Emissions Inventory for 'Single-Engine Taxi-Out' Operations," Proceedings International Conference on Research in Air Transportation (ICRAT-2008), Fairfax, VA, February 2008.

nearly half of the pilots surveyed indicated that they would use single-engine taxiing on wet taxiways.

Cold starts did not appear to be a significant factor affecting use of single-engine taxi procedures. A majority of pilots (67%) indicated that if they were departing in the morning after their aircraft had been sitting idle overnight, it would not affect their decision to use single-engine taxiing.

Survey respondents were asked to list any other conditions when they would not use single-engine taxi procedures. The most frequent responses were:

- ice or snow
- high gross weight
- short taxi-times, uncertainty of departure time and position in the takeoff queue, and changes in runway assignments
- hot days on asphalt surfaces

Engine Shutdown Procedures

Based on their airline and equipment flown, a majority of pilots (80%) shut down or leave off a specific engine when utilizing single engine taxi procedures. Although many pilots cited "procedure" or "habit" as their primary reason for shutting down or leaving off a specific engine during single engine taxiing, it is also driven by which engines power essential aircraft systems such as hydraulics and brakes.

Other key considerations include which side the cargo doors are on, aircraft cooling, and the taxiway configuration at the airport (e.g. how many right or left turns will the aircraft need to make during taxi-out or taxi-in).

On departures, pilots wait until an average of 4.6 minutes before takeoff before starting the last engine, and 3.1 minutes after landing to shut down an engine.

Runway Configuration Issues

One of the key reasons that pilots might not use single-engine taxi procedures is that they might anticipate a short taxi-out or taxi-in time. Most pilots indicated that in order to consider using single-engine taxiing for arrivals, the expected taxi-in time would have to exceed 10 minutes (on average); for departures, they would need to expect their taxi time to exceed 20 minutes. For example, at Boston Logan Airport, pilots indicated that they do not typically use single-engine taxi-out procedures to runways 9, 4L, and 15R, which are closest to the gates. The most common reason cited for not using single-engine taxiing at BOS was the proximity of the gate to the runway, and the resultant short taxi time. However, there were other reasons cited for not using the procedure, including:

- length of queue
- complex layout
- busy taxiway areas

Advanced Queue Management Strategies and a Willingness to Wait

Researchers at MIT are currently investigating advanced queue management strategies that would minimize surface fuel burn and emissions. Such strategies might hold aircraft at the gate or in holding areas in order to minimize taxi time, while also aiming to minimize delay. When pilots were asked whether they would be willing to wait at the gate if their position in a takeoff queue could be

guaranteed, 61% indicated that they would *definitely* be willing to wait, and an additional 16% indicated that they would *probably* be willing to wait.

Conclusions

A majority of pilots responding to this survey believe fuel conservation is an important issue, and that this belief is primarily motivated by concerns about the cost of fuel, company profitability, and the impact of aviation on the environment. A majority of airlines appear to encourage single-engine taxi procedures, as well as a variety of other fuel conservation measures.

The survey found that a majority of pilots used single-engine taxi procedures on arrival at airports, while a fewer number of them used single-engine taxi on departures. Key reasons cited for not using these procedures were either safety-related, or associated with practical reasons (such as short taxi distances for some runways at BOS). Single-engine taxi procedures differed between aircraft in terms of which engines were left off, and for how long. Even though this survey was based on a convenience sample, it provided some useful insights regarding airline pilots' attitudes to fuel consumption, as well as information on the use of fuel conservation measures such as single-engine taxiing.

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